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Sleep habits of high school students: An intervention to improve them

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**SLEEP HABITS OF HIGH SCHOOL STUDENTS:
AN INTERVENTION TO IMPROVE THEM**

by

John Edward Wallace, B.A., M.S.W.

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

COLLEGE OF EDUCATION
LOUISIANA TECH UNIVERSITY

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We hereby recommend that the dissertation prepared under our supervision
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entitled Sleep Habits of High School Students: An Intervention to Improve Them

be accepted in partial fulfillment of the requirements for the Degree of
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ABSTRACT

Adolescence is a time of tremendous growth: physically, cognitively, socially, and emotionally. Many experts state that good sleep habits are very important for adolescents and emotional well-being. The few studies of adolescents' sleep habits have reported that many high school-age students sleep less than eight hours when their bodies actually need nine hours a night. Research has found a relationship between shortened sleep duration and chaotic sleep patterns to overall poor school performance.

Sleep problems among adolescents have been found to be associated with anxiety, depression, inattentive behavior, social problems, aggressive behavior, and delinquency. Additional studies indicate that adolescents who regularly get insufficient sleep experience reduced functioning in such areas as school performance, safety issues, and interpersonal relationships. Furthermore, most adolescents do not realize the importance of sleep or simple actions they can practice to improve the quantity and/or quality of their sleep. The purposes of this study were to investigate the relationship between high school students' sleep habits, their knowledge of sleep hygiene, and to evaluate the effects of a psychoeducational intervention on students' sleep habits. This study consisted of two parts. Part A gathered survey information from a sample of the total school population to explore relationships among sleep duration, sleep quality, grade point average, general physical health, general mental health, and attendance. Part B examined the affect of a thirty-minute psychoeducational presentation on sleep duration, sleep quality, sleep hygiene knowledge, and sleep hygiene practices.

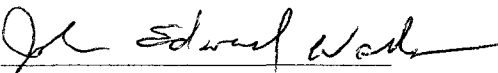
This study found that students did not sleep enough hours, experienced poor sleep quality, and experienced negative consequences for these behaviors. It was also found that a thirty-minute psychoeducational presentation was not effective in increasing sleep amounts, improving sleep quality, increasing sleep hygiene knowledge, or improving sleep hygiene practices.

The results suggest that students who sleep for short amounts and have poor sleep quality may expect to experience decreased physical health, poorer mental health, and more school absences. This also demonstrated that a single, short presentation was not effective in changing the sleep length, sleep quality, sleep hygiene knowledge, or sleep hygiene practices. This finding indicates that different strategies should be tested and used to improve sleep among high school students. Additional implications of the findings for school counselors are also delineated.

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CHAPTER ONE

INTRODUCTION

According to developmental theorists, high school students experience physical, cognitive, and psycho-social changes (Maslow, 1970; Erikson, 1963; Piaget, 1963). As adolescents enter puberty they experience dramatic biological changes that effects their hormonal balance, the shape of their bodies, and the architecture of their brain. From approximately 12 years of age until late teens, adolescents mature from looking, thinking and acting like a child into individuals with an adult physique, cognitive capacities of an adult, and the social tools to address the adult world (DeHart, Sroufe, & Cooper, 2000).

Teenagers experience rapid changes and growth in their bodies during this developmental stage. This biological maturation is linked to changes in physical capacities, cognitive abilities, and sexual interests (Carskadon, 2002). Their bodies actually grow more quickly than any other time except during early infancy. The most noticeable changes for males include sudden bursts of growth in height, broadening of shoulders, and secondary sexual characteristics such as voice changes and facial and pubic hair growth. Females experience development of breasts and a widening of the hips and the pelvic area. For females, these growth changes accompany menarche. The hormones testosterone and estrogen are largely responsible for the biological changes that accompany the teenage years. The relative amounts of production of these hormones in each individual influence the development of adult reproductive organs, sex drive, and

overall body build (Tanner, 1990). These biological changes in physical growth and puberty are occurring at an earlier age and resulting in progressively larger overall physical sizes according to secular trend theory (Garn, 1987; Tanner, 1981). A study comparing adolescents from 1956-57 to adolescents in 2005-06 found that at age 15.5, boys on average were 10 cm taller and 15 kg heavier while girls were 13 cm taller and 9 kg heavier (Marques-Vidal, Madeleine, Romain, Gabriel, & Bovet, 2006). Additionally, a study by Okasha, McCarron, Smith, and McEwen (2001) compared students' age of menarche and they found that mean age of menarche decreased from 13.2 to 12.5.

Along with changes in physical development, the architecture of the brain also undergoes dramatic changes. Adolescents' brains experience a decline in plasticity and an increase in functional efficiency (DeHart, Sroufe, & Cooper, 2000). The decrease in plasticity may be caused by hemispheric specialization and the pruning of synapses. As the brain matures, specific cognitive processes such as speech or logic are localized in either the left or right hemisphere of the brain. This is called hemispheric specialization. As the brain localizes some functions the number of synapses decrease or are pruned based on the amount of activity in that area of the brain. As these changes reduce plasticity of the brain there are other factors that increase the efficiency of the brain. An increase in efficiency may be due to an increase in gray matter and myelination. Just before puberty, there is an overproduction of gray matter similar to that experienced in infancy (Giedd et al., 1999). After puberty the brain undergoes a process of myelination that results in fatty insulation developing around the nerve fibers (Graber & Peterson, 1991). It is this growth of myelin around the nerve fibers that is responsible for increased efficiency of brain functioning.

In addition to the physical changes students undergo, teenagers also undergo changes in the way they think. Teenagers begin to develop abstract cognitions. Jean Piaget (1952) theorized that adolescents develop “formal operational” thought processes; that is, they can conceptualize unique outcomes, use systematic or scientific reasoning to solve problems, and combine or integrate ideas in a logical fashion (Seifert & Hoffnung, 1997). Piaget believed that formal operational thought was a developmental factor rather than a learned skill. Further research, particularly by information-processing theorists, beginning with Atkinson and Shiffrin (1968), explored the way students input, store, process, and output information (Driscoll, 2000). Research suggests that teenagers develop abstract thought characterized by improved short- and long-term memory, use of learning strategies, selective attention, automatization of basic cognitive skills, and metacognition or the ability to think about thinking (DeHart et al., 2000).

The psycho-social changes during adolescent effect the way teenagers view themselves and the way they view the world. As teenagers change biologically and acquire more complex cognitive skills, they reevaluate their identity and their roles in the world as separate and distinct from their parents and family. Erik Erikson (1963) described this change as the crisis of identity versus role confusion. Teenagers reconsider their skills and abilities and as a result begin developing a unique identity. During this stage Erikson theorized that teens explore and experiment with different roles and identities to discover what fits and works best for them. Teenagers often exhibit a psychosocial moratorium (Erikson, 1975) which allows the adolescent to postpone making adult commitments such as career, social causes, moral standards, and relationships.

The majority of adolescents mature through this developmental period without excessively high levels of "storm and stress." However, large numbers of adolescents experience some difficulties (Eccles, Lord, Roeser, Barber, & Jozefowicz, 1996). As the adolescent body goes through these important changes, the amount of sleep needed actually increases to approximately nine hours a night (Carskadon, 2002). Unfortunately, social interactions and technological advances tend to encourage later bedtimes (Hicks & Pelligrini, 1991) while the school start time remains early in the morning. It may be that adolescents are getting less sleep and poorer quality sleep during this important life-stage.

Importance of Sleep

The importance of sleep for physical and emotional well-being has been universally accepted (Angus, Heslegrave, & Myles, 1985; Banks & Dinges, 2007; Carskadon, 2002; Dement, 2000). Sleep is a basic drive of nature (Maslow, 1970) and is necessary for our basic functioning. Quality sleep enhances cognitive functioning, emotional interactions, completion of complex tasks, and enjoyment of everyday life.

The amount of sleep each night is critical for adolescents. A study by Wolfson and Carskadon, (1998) found that adolescents in the United States average seven hours, 42 minutes of sleep at age 13, and that sleep time decreases to seven hours, four minutes by age 19. Over a quarter (26%) of high school students reported sleeping six and one-half hours or less during the school week. A longitudinal study of high school students revealed between 54.3% and 74.5% of students desired more sleep. The students, on the average, wanted 1.7 hours more sleep nightly during the school week (Strauch & Meier, 1988). In the general population of this country, more than one third may suffer chronic partial sleep deprivation or poor sleep quality from poor sleep habits (Bonnet, 2000; Bonnet & Arand, 1995).

As students experience later bedtimes and maintain early school start times, they often compensate by sleeping longer hours on weekends (Pelay, Thorpy & Glovinsky, 1988). Such a schedule may result in Delayed Sleep Phase Syndrome (DSPS). DSPS is a normal occurrence in adolescence and has been found as a factor in student sleepiness during school (Gibson et al., 2006). The prevalence of DSPS for adolescents was reported as 7.3% of the population (Pelayo et al., 1988). Students who are slightly older and attend college have been shown to report symptoms consistent with DSPS more than younger adolescents and twice as often (11–17%) as the general population (Brown, Buboltz, & Soper, 2001). People suffering from this disorder may experience poor job/school performance during the week as well as excessive sleepiness.

Some of the effects of the lack of quality sleep include issues of safety, physical health, mental functioning, somatic complaints, and mood disturbances. Drivers who experienced excessive sleepiness caused automobile accident rates to rise seven times higher than the general population (Findley, Unverzagt, & Guchu, 1995; Findley, Unverzagt, & Suratt, 1988). Chronic reduction of sleep may dramatically weaken the immune system's response to infection (Irwin, McClintick, & Costlow, 1996). Healthy, well-adjusted students subjected to one night of poor sleep reported more somatic complaints and psychological complaints (Zammit, 1988). Two studies investigated the relationship between sleep and cognitive behaviors and found that limited sleep resulted in difficulties with visual motor reaction time, critical thinking abilities, vigilance, attention to task, and reaction time (Taub, 1980; Taub & Berger, 1974). These behaviors and reactions may be very important to young adolescents attempting to develop their identity and complete high school.

College students regularly complain about school demands which require all night sessions of work and study. Fully two-thirds of college students report occasional sleep difficulties and one-third report regular and severe sleep disturbances (Brown, Buboltz, & Soper, 2001; Coren, 1994; Lack, 1986). In a study by Brown et al. (2001), only 11% of college students reported sleep that met the criteria for quality sleep. The remainder of the sample complained of moderate to severe sleep difficulties. Hicks and Pellegrini (1991) found that college students on average reported a one hour decrease in sleep time in a 20 year span from 1969 to 1989.

Research (Bonnet et al., 1995; Brown, Buboltz, & Soper, 2002; Brown, Buboltz, & Soper, 2001) indicates that university students may disregard the need for good sleep more than the general population. Students do not realize that poor sleep can affect their academic performance. Students who stay up all night prior to a critical thinking test performed worse but believed they performed better than students who had sufficient sleep (Pilcher & Walters, 1997). The authors speculated that perhaps students who rely on late-night cram sessions to prepare for tests may not be aware that their poor performance was affected by lack of sleep rather than other factors.

Furthermore, students may be unaware of the important factors of good sleep hygiene. Hicks et al. (1999) found that many students are unaware of the behaviors related to sleep quality. The average student could correctly answer only 50% of the sleep hygiene knowledge questions. They also found a correlation between average sleep length and knowledge of sleep hygiene: students with more knowledge of sleep hygiene sleep more than their uninformed classmates (Hicks et al. 1999).

Dement (2000) notes that sleep is an extremely active time during which complex neurological, physiological, and hormonal changes transpire. Studies (Bonnet, 2000;

Bonnet & Arrand, 1995; Carskadon & Dement, 1987) have documented some of the symptoms of poor sleep habits, such as decreased concentration and alertness, inconsistent performance, reduced performance, negative mood, poor learning ability, impaired short-term memory, and impaired behavioral control (NIH, 1997).

Most of the above cited research has used adults or college students. High school age adolescents are suspected to have similar difficulties, but little research has examined the sleep patterns of high school students and their relationship to academic outcomes. Previous studies of the adolescent population have found a decline in sleep duration and sleep quality (Pelayo, Thorpy, & Glovinsky, 1988; Wolfson & Carskadon, 1998). No study to date, however, has attempted to explore if, how, and to what degree sleep factors impact adolescents' health and academic performance. These studies explored the sleep habits and sleep hygiene knowledge of high school students, investigated the relationship between sleep and academic outcomes, and measured the efficacy of training in improving sleep hygiene knowledge and behavior.

Conceptual Framework

The impact of limited sleep or poor quality sleep on all phases of physical and psychological well-being fits within the conceptual framework of the psychological theory of Abraham Maslow (1970). In addition, the basic need for sleep in adolescents is also addressed in the theoretical concept of wellness in the national counseling model of the American School Counselor Association (ASCA, 2003). Poor sleep habits among adolescents and school children that impact academic performance are also an important issue for school counselors as they encourage and promote academic, career, and personal/social development of students (American School Counselor Association, 2003).

Maslow's Theory

The theoretical value of sleep to psychological development and motivation was addressed by Abraham Maslow. Maslow (1970), one of the founders of Humanistic Personality Theory, considered sleep as a primary physiological need. He asserted that a hierarchy of needs accounted for the range of human motivation. He conceptualized the five levels of needs as a pyramid. Each level must be met before the next level can be attained. The hierarchy, from the most basic to the apex, includes five needs that motivate individuals: physiological, security, belonging/love, esteem, and self-actualization. Sleep is a critical element of every individual's basic physiological needs. For adolescents, sleep may be one of the basic needs most lacking. Maslow postulated that unmet needs in the areas of physiology, safety, love and belonging, and esteem will cause the individual to feel anxious and tense (Maslow, 1943). Thus, it can be postulated that individuals can actively change such behaviors as poor sleep habits to grow and realize their fullest potential. The ability to grow and to realize ones full potential is explicit in all humanistic theories (Wood & Wood, 1993).

Maslow's hierarchy of needs is intuitively appealing. The fulfillment of basic physiological needs such as air, food, water, sex, and sleep are accepted as basic motivations. A study (Keys, Brozek, Henschel, & Mickelson, 1950) of food deprivation validates Maslow's theory on physiological needs. The experimental group whose caloric intake was manipulated not only lost weight but lost interest in everything else but food. The result of this study is an example of how basic physiological needs significantly reduce pursuit of higher needs.

Maslow's categories of belonging and love received support from Baumeister and Leary (1995). They reported that analysis of a large number of empirical studies support

that the fulfillment of belonging/love needs affected health, well-being, and adjustment. However, Maslow's theory has not been well received by other researchers. Wabha and Bridwell (1976) reviewed the research based on Maslow's theory and did not find evidence for a hierarchy of needs. A more recent study (Soper, Milford, & Rosenthal, 1995) pointed out that Maslow's theory continued to be popular, particularly in the field of marketing, but there was a lack of empirical evidence to support the motivational theory.

ASCA National Model

The emphasis on getting a good night's sleep and how proper sleep can impact academic performance was addressed by the American School Counselor Association (ASCA). The American School Counselor Association (2003) has challenged school counselors to encourage and promote academic, career, and personal/social development of students. This emphasis includes all areas of students' lives that impact their development at school, including proper sleep habits. Limited sleep among adolescents and children may impact their academic performance and achievement. The goal of developmental guidance is "to promote emotional, social, and cognitive growth while preventing problems in the lives of young people" (Baker & Gerler, 2001, p. 300). Promoting good sleep habits can be considered part of at least seven of the recommended goals developed for school counselors by the ASAC. Dixon-Rayle and Myers (2004) state that overall wellness of adolescents may be addressed through psychoeducation presentations about healthy habits that students need to develop before adulthood.

Statement of the Problem

Reduced sleep has detrimental effects on academic abilities and many other aspects of functioning. Compounding this problem is the lack of knowledge of behaviors

that promote sleep quality. Hicks et al., (1999) reported that students completing a questionnaire about sleep hygiene knowledge could answer about 50% of the questions correctly. It is expected that high school students may be equally uninformed of sleep hygiene practices. Brown (2002) found that a psychoeducational intervention with college students resulted in significantly better sleep hygiene practices over time. These findings are consistent with other studies that demonstrated the efficacy of psychoeducational interventions for sleep hygiene (Friedman et al., 2000; Hryshko-Mullen, Broeckl, Haddock, & Petterson, 2000; McCurry et al., 1998; Morin et al., 1994; Murtagh & Greenwood, 1995; Riedel, 2000). Despite the empirical support for psychoeducational interventions and the need for them in the high school population, such interventions have not been tested with this population.

Statement of Purpose

The purposes of this study were to analyze the relationship between high school students' sleep habits and academic and health factors, and to evaluate the effectiveness of a psychoeducational intervention on students' sleep habits. The sleep habits of high school students have been explored in some previous studies (Hutchison, 2003; Iglowstein et al., 2003; Wolfson & Carskadon, 1998; Strauch & Meier, 1988). The overall findings from these studies were that adolescents and young adults get insufficient sleep which adversely impacts their lives and performance in important life areas such as school performance, safety issues and interpersonal relationships. Additionally, the findings reveal that most adolescents do not realize the importance of sleep nor simple actions they can practice to improve the quantity and/or quality of their sleep. This study examines the sleep habits of adolescents in grades nine through twelve and their

relationship to academic behavior. This study also explored the effects of a short psychoeducational program on students' sleep habits and knowledge.

Literature Review

Research on sleep, sleep processes, problems, and the effects of sleep is increasing. The increased research on sleep and its effect on behavior, however, has focused much less on adolescents than other populations. After a cursory overview of historical foundations of sleep and the description and processes of sleep, this review examines more closely sleep duration and the effects of poor sleep habits on all phases of adolescent development.

Historic Foundation

Throughout early history, sleep was considered mysterious. Early beliefs attributed sleep and dreaming as a means for communicating with gods. Eastern civilizations may have first considered dreams as communication from the Creator. Such ideas were also found in the theological beliefs of Jewish and then subsequently Christian religions. The pantheon of gods for both the Greeks and Romans had a place for sleep. For the Greeks, Hypnos, for the Romans, Somnus, were the personification of sleep. Sleep was similar to or related to death. As Hypnos represented sleep, his twin, Thanatos, represented the god of death. Additionally, the general concepts found in dreams were represented by Hypnos's three sons. The Greek philosopher Aristotle disagreed with the prevalent supernatural reason for dreams. He asserted that dreams come from within the Self instead of the gods or the neither world. Whether dreams were from the world of the dead, the gods, or the self, people remained interested in the meaning of those dreams (Thorpy, 1991).

Sigmund Freud brought the interpretation of dreams to the scientific world. He believed that dreams were about the dreamer. He called dreams “the royal road to Self knowledge” in his work *Interpretation of Dreams* (Freud, 1955). He offered that dreams reflect the instinctual drives of aggression and sex from our unconscious. The Ego moderates and attempts to reconcile the instinctive drives that derives from the unconscious Id and the learned inhibitions of the Superego. From this conflict the instinctual drives are manifested in dreams. Freud postulated that dreams were essentially symbolic and had two layers of content. Manifest content is symbolic of our unconscious desires and the part of the dream we can remember. The latent content is the underlying meaning of the symbols appearing in our dreams that the ego has difficulty accepting (Freud, 1955).

Soon after Freud’s examination of sleep and dreams, research began on the physiology of sleep. In 1913, French scientist Henri Pieron authored a book entitled *Le probleme physiologique du sommeil* (Dement, 1999). This is usually considered the beginning of the modern approach to sleep research. Hans Berger researched the electrical activity within the human brain. This led to the development of electroencephalography (EEG) (Karbowski, 2002). By using the EEG, he was the first to describe the different waves or rhythms which were present in the normal and abnormal brain. In the 1920s, Nathaniel Kleitman, now known as the “Father of American sleep research,” began work at the University of Chicago. He explored regulation of sleep and wakefulness and circadian rhythms. Kleitman’s most important studies focused on the effects of sleep deprivation on different populations (A Brief History of Sleep Research, 1999). Research in sleep added new tools which increased our knowledge of the sleeping body. These included measurement of eye movement with electrooculographs (EOG),

measurement of the brain's electrical activity with electroencephalography (EEG), and electromyographs (EMG) measuring muscle tension in the chin (Dement, 2000; Kleitman, 1963). Currently, sleep clinics continue to use these techniques, but also explore oxygen levels, muscle activity, and cardiac rhythms to diagnose sleep disorders (Hirshowitz, Moore, & Minhoto, 1997).

Function of Sleep

Even with the scientific findings of the past century, the functions of sleep are not completely understood. It is suspected that sleep began as a basic function of the man's early form but has evolved to perform multiple functions. The mainstream theories of the functions of sleep include the following: restoration, anabolic/catabolic, ontogenesis, memory processing, and preservation.

Sleep is a time of cellular rebuilding and growth. Sleep affects the healing of wounds. Research investigating the healing of burns on rats (Gumustekin et al., 2004) found that sleep deprivation hindered healing. Some studies have demonstrated that different stages of sleep effect an organism's growth as well (Arch, Browman, Milter, & Walsh, 1988). A more recent longitudinal study did not find a correlation between parent-reported time-in-bed and physical growth (Jenni, Molinari, Caflisch, & Largo, 2007). Another study found that growth hormone levels in men are affected particularly by slow-wave sleep (SWS). There is a relationship between high growth hormone secretions and a high percentage of SWS (Van Cauter, Leproult, & Plat, 2000).

The immune system and metabolism of mammals are affected by sleep deprivation. In a study by Zager, Andersen, Ruiz, Antunes, and Tufik (2007), rats were deprived of sleep for 24 hours and displayed a 20% decrease in white blood cell count. The sleep-deprived rats' blood tests indicated a significant change in the immune system.

Additionally, sleep affects metabolism. Sleep is when anabolism occurs (Bonnet & Arand, 2003). Anabolism is a constructive type of metabolism (Biology-online, 2009). It is during the non-REM sleep when anabolism occurs that results in the growth and rejuvenation of the body's immune, skeletal, nervous, and muscular systems. The Bonnet et al., (2003) study found significantly greater metabolism values for normal sleepers than short sleepers.

There is also an “ontogenesis theory” to describe some functions of sleep. Ontogeny is defined as, “The history of structural change in a unity, which can be a cell, an organism, or a society of organisms, without the loss of the organization that allows that unity to exist” (Maturana, & Varela, 1987, p. 74). This theory holds that deprivation of non-REM sleep activity, particularly during neo-natal development, may result in smaller brain mass, sleep difficulties throughout life, and continuing behavioral problems (Mirmiran et al., 1983). Research conducted by Marks, Shaffery, Oksenberg, Speciale, and Roffwarg (1995) concluded that an important factor for development of human infants is neonatal REM sleep (or active sleep). Deprivation of active sleep (REM) during early life can result in an abnormal amount of neuronal cell death (Morrissey, Duntley, & Arch, 2004).

Sleep is strongly related to memory. Turner, Drummond, Salamat, and Brown (2007) found that the average working memory span of a sleep-deprived group dropped significantly compared to a control group with normal sleep schedules. There are also indications that time of stages of sleep has differing effects on memory. Recent studies seem to indicate that late stage sleep, where REM occurs, improves procedural memory. The early short-wave-stage (SWS) sleep is more beneficial for declarative memory (Born, Rasch, & Gais, 2006). These findings are corroborated by controlled animal

studies. Rats in the learning' group spent 180% more time in SWS than the control group (Datta, 2000). Research with humans concurred that SWS sleep improves nondeclarative memories (Ellenbogen, Hulbert, Stickgold, Dinges, & Thompson-Schill, 2006). These and other studies have led sleep researchers to postulate that sleep of adequate duration and good quality improves recently acquired, nondeclarative memories.

Description of Sleep

Sleep is important in the daily functioning as well as our mental and physical health. During sleep our brains are very active. Neurotransmitters and neurochemicals control our waking and sleeping by acting on different neurons within the brain. The *Encarta Dictionary* describes sleep as “a state of partial or full unconsciousness in people or animals, during which voluntary functions are suspended and the body rests and restores itself, or a period spent in that state.”

Sleep is the natural state of the body at rest. Sleep is a natural function of all mammals and birds and is common in most reptiles, fish, and amphibians. Survival requires regular sleep. Sleep was considered a passive and dormant part of our daily lives until the 1950's. Beginning in that decade, researchers began exploring the physiological and psychological aspects of sleep. Within several seconds after falling asleep, automatic behaviors cease (Carskadon & Dement, 1979), visual responses end (Guilleminault, Phillips, & Dement, 1975), and most auditory evoked responses (Ogilvie & Wilkerson, 1984) cease. The body in a coma differs from a person asleep. In a coma, a person does not physically respond to stimuli, but sleepers may respond to some stimuli. Studies have reported that sleepers may respond to stimuli such as very loud noise, the call of their name, or unusual sounds (Williams, Hammock, & Daily, 1964). Measurements of the

physiology of sleep are made using polysomnographic equipment that measure brain waves (EEG), eye movements (EOG), and muscle tension (EMG).

The advent of electroencephalogram (EEG) in 1928 provided scientists with the ability to measure the electrical activity of the brain. The EEG measures the electrical wave frequency, number of waves per second, and the microvolt electrical activity or the height of the wave through electrodes placed on the scalp of a subject. Researchers have identified four distinct levels of brain waves.

Brain activity can be measured by the amount of electrical discharges. The EEG measures the space between electronic discharge waves. When a person is awake, brain waves consist almost entirely of alpha and beta activity. Beta waves are measured at a frequency of 12 hz - 38 hz. This is generally the mental state most people are in during the day when they are active and productive. Alpha waves are measured at 8 hz - 12 hz frequency. Alpha waves indicate the person is awake but relaxed and not processing much information. This is a person's natural state upon waking or just before sleep. Theta brain waves are at the 3 Hz - 8 Hz frequency and are the mark of light sleep or extreme relaxation. Delta waves (0.2 Hz - 3 Hz) are the slowest of brainwaves. This occurs during deep and dreamless sleep. The onset of sleep may be measured by the gradual reduction, then cessation of alpha waves and the onset of theta wave spikes.

Measurement of eye movements (EOG) requires electrodes to gauge the activity of eye muscles. It is very valuable to record and measure times stages of REM (Rapid Eye Movement) and non-REM sleep. During the stages of non-REM sleep, there is an absence of rapid eye movement and blinking. Instead, the eyes move in a very slow, rolling action. While in REM sleep, the individual's eyes rapidly move, and there is a rapid, low voltage EEG.

Electromyography (EMG) is a method for evaluating and recording the activation signal of muscles. The activation signal of muscles are the electrical generated when cells contract or when they are at rest. There is a distinct difference between findings during REM and non-REM sleep. During non-REM sleep, subjects are in a relaxed state similar to times of relaxation when awake. During REM sleep electrical potential within voluntary muscles is so low as to resemble paralysis.

Polysomniography equipment has enabled researchers to identify distinct patterns in the process of sleep. Sleep may be generally described as the cessation of alpha waves, spikes of theta waves, reduction of eye movement to slow and gently rolling of the eyes, and most voluntary muscles are relaxed (Rechtschaffen & Kales, 1968). These techniques have also led to the labeling of sleep stages, first by Rechtschaffen and Kales called the R & K standard (Rechtschaffen et al. 1968). In 2007, the American Academy of Sleep Medicine (AASM) published a revision of the *The AASM Manual for the Scoring of Sleep and Associated Events* (Iber, Ancoli-Israel, Chesson, & Quan, 2007) which merged the third and fourth stages of sleep, leaving only a third stage. The sleep research standard is now three non-REM stages of sleep and one stage of Rapid Eye Movement (REM).

Sleep Stages

Sleep begins with the feeling of drowsiness and closing of the eyes. The brain is relaxed as measured by alpha wave patterns. Stage 1 (N1) sleep begins as the brain slows to theta waves (with a frequency of 4 to 7 hz). This stage lasts for a few minutes. The muscles begin to relax and there is loss of alertness. This stage is sometimes referred to as *somnolence*, or "drowsy sleep". If aroused during this time, the person may deny being

asleep (Hobson, 1995). Many individuals who complain of lack of sleep or insomnia spend more time in stage 1 sleep (Carskadon & Dement, 2000).

After approximately 10 minutes in N1, an individual enters Stage 2 (N2) sleep. This stage is characterized by "sleep spindles" (12 to 16 hz) and "K-complexes." Sleep spindles are short EEG wave bursts with an average of 11.5 to 16.0 cycles per second that last for 0.5 seconds or more. K-complexes are sudden, sharp, high amplitude waves followed by a smaller positive wave.

During N2 sleep muscular activity slows and consciousness disappears. Approximately half of adult sleep is spent in the N2 stage. Each night adults spend approximately 10-25 minutes in stage N2 sleep (Carskadon & Dement, 2000). As sleep becomes deeper, K-complexes and sleep spindles decrease as delta waves increase. Delta waves are slow, high amplitude waves of less than 3.5 hz. Delta waves increase until they make up more than 50% of the brain waves. This is referred to as "slow-wave sleep" or "deep sleep." Recent studies have conclusively determined that no evidence was found to justify dividing slow wave sleep into two stages (Silber, et al., 2007). During this slow-wave or deep sleep, it is very difficult to wake the sleeper. It has been noted that stage N3 sleep may be less prevalent or absent in older adults, particularly men (Hirshkowitz, Moore, Hamilton, Rando, & Karacan, 1992). Children tend to have longer stage N3 sleep than adults. The length of stage N3 sleep decreases dramatically during adolescence. Parasomnias, which are undesirable motor, verbal, or experiential phenomena that occur during the sleep period, generally occur during the early hours of sleep during stage N3 (Mahowald & Schenck, 1996). The three most common parasomnias among children are confusional arousals, sleep terror, and sleepwalking. For both children and adults, N3 is a state of deep sleep. During this deep sleep it is difficult to wake a child, particularly

during the first sleep cycle. Awakened during this stage, a person is likely to display confusion, return immediately to sleep, and not remember the incident later (Williams, Karacan, & Hirsch, 1974; Bonnet, 2000). Slow wave sleep, sometimes referred to as SWS, increases after unusually high amounts of exercise (Trinder, Paxton, Montgomery, & Frasier, 1985) and after a physically active day (Horne & Mindard, 1985). Sleep time in SWS is greater than other stages following a night of sleep deprivation (Angus, Heslegrave, & Myers, 1985; Bonnet, 2000). The greatest amounts of growth hormones are released during this sleep stage (Sassin, Parker, & Johnson, 1969).

The final stage of sleep is REM or Rapid Eye Movement sleep stage. Sleep characterized by Rapid Eye Movement (REM) was first identified by Kleitman and Aserinsky in the early 1950s. This stage does not immediately follow stage N3. Instead, the sleeper cycles back through N2. The sleeper then enters REM (Carskadon & Dement, 2000). REM sleep is identified by rapid eye movements, irregular heartbeat, blood pressure changes, low muscle tone, heightened sexual arousal, and a rapid low voltage EEG. Brain activity is similar to that recorded when awake. It is during this stage that the sleeper dreams. Research finds that sleepers awakened during the REM stage almost always report dreaming. REM sleep is also called 'paradoxical sleep' because the brain paralyzes the muscles and inhibits neural activity in the brainstem even though the brain is active. This muscle paralysis protects from self-injury during dream states (Schenck, Bundlie, Ettinger, & Mahowald, 1986). Most adults experience about four or five periods of REM sleep for an average of 90 to 120 minutes each night. REM sleep comprises 20-25% of total sleep time. REM cycles are short at the beginning of the night and then progressively lengthen. It is suspected that REM sleep is very important for consolidating newly learned information (DeKoninck, Lorain, Christ, Proulx, & Coulombe, 1989;

Dewain, 1970; Ellman, Spielman, & Lipschutz-Brach, 1991; Karni, Tanne, Rubenstein, & Askenasy, 1994; Nesca & Koulack, 1994; Winson, 1990). Students deprived of REM sleep perform significantly worse on tests than students who were not deprived (Karni et al., 1994; Pilcher & Huffcutt, 1996; Pilcher & Ott, 1998; Pilcher & Walters, 1997; Smith & Lapp, 1991). These findings are supported by animal studies (Silvestri, 2005) where rats deprived of REM sleep learn cues slower. These results provide further evidence for the involvement of REM sleep in learning and memory processes. Other studies have found a relationship between REM sleep and memory storage. Mesulam (1995) and Sitaram, Moore, and Gillin (1978) indicate that cholinergic receptors play a key role in both memory storage and REM sleep.

There is a complex relationship between REM sleep, emotion and motivation. Ellman et al., (1991) found that REM sleep affected the locus coeruleus and sub-cortical pleasure centers. The limbic structures of the brain are activated during REM sleep. The limbic structures are crucial to motivation, learning, memory, and emotional behavior. William D. S. Kilgore and colleagues (2007) at Walter Reed Army Institute evaluated the responses of subjects to three types of moral dilemmas on two separate occasions: at rested baseline and then again after 53 hours of continued wakefulness. Sleep deprivation resulted in significantly delayed responses. The subjects also had greater difficulty choosing a response to personal moral dilemmas. Kilgore reported that the subjects were unable to integrate emotions and cognitions to make moral judgments. These results indicated that sleep loss is particularly disruptive to the ventromedial prefrontal regions of the brain (American Academy of Sleep Medicine, 2007).

Normal sleep is comprised primarily of short-wave-sleep. This occurs generally during the first part of the sleep occasion. During the second half of the sleep experience,

the subject is usually engaged in REM sleep (Carskadon & Dement, 2000). Research on total sleep deprivation found that the first night of sleep was marked by considerably more short-wave sleep (Carskadon & Dement 2000). The second night the subjects rebounded with more REM sleep. These results supported their hypothesis that the body places emphasis primarily on physical health and secondarily on neurological health. Such a preference for SWS increases the likelihood that the subject will remain physically healthy. The sleep deprived individual may suffer from the more subtle difficulties of reduced attention, impaired memory, and mood difficulties.

The quantity of sleep needed for each individual is determined by several factors. Age is one of the most important factors. To develop and function properly, children need a large amount of sleep. Newborns need up to 18 hours each day, but the hours of sleep needed decline as a child ages (de Benedictis, Larson, Kemp, & Barston, 2000; National Sleep Foundation, 2008). During the first 2 - 6 months of life, infants do not exhibit a defined REM sleep pattern. It is hypothesized that the infant's central nervous system is developing and the brain is incapable of producing high voltage SWS (Carskadon & Dement, 2000). Once the infant develops the ability, REM sleep will characterize almost 9 hours of the infant's sleep each day but will decrease to approximately two hours each day by age five (Siegel, 1999).

The child between the ages of five to 12 years old needs increasingly less sleep. Adequate amounts of sleep may decrease from 11 to nine hours each night. The sleep of this age group is characterized by a large percentage of SWS and REM sleep. There seems to be very little between stage 1 and stage 2 (transitional) sleep. Children are difficult to wake even with loud noises (Busby & Pivik, 1983).

Adolescents need more sleep than they think. Early research indicated teens need 8.5 to 9.25 hours of sleep each night (Carskadon et al., 1980). Carskadon (2002) has recently reported that teenagers need 9.25 hours of sleep each night. Most teenagers, however, get only about seven hours of sleep on school nights. As teenagers progress through adolescence, there is a 40% reduction in REM sleep even though the total amount of sleep remains the same (Carskadon & Dement, 1987). Adults, including the elderly, need an average of seven to eight hours of sleep. By the age of 80, the amount of time in stage 1 and stage 2 increases and SWS sleep decreases. The amount of REM sleep does not change in healthy adults although it has been noted that older adults who suffer from dementia exhibit a marked decline in REM sleep (Prinz, Peskind, & Vitaliano, 1982). Nocturnal awakenings, some remembered and some not, increase with age (Carskadon, Brown, & Dement, 1982). Prinz (1977) established a correlation between intellectual functioning and the amount of REM sleep. A more recent study found that REM sleep disorder preceded or coincided with the onset of cognitive decline in 94% of the patients. All but one patient with REM sleep disorder and dementia had one or more of the following clinical features: visual hallucinations, extrapyramidal signs, or fluctuating cognition/alertness (Ferman et al., 1999). Indeed, it seems that elderly patients with 'idiopathic' REM sleep disorders are actually exhibiting an early clinical manifestation of an evolving neurodegenerative disorder (Boeve et al., 2007).

Research within the past eight decades has provided significant changes in the way sleep is understood. In the past, sleep was considered a passive activity or even an opportunity for visions or communications with gods. Now research and technology is discovering that during sleep the human organism is active with complex neurological, physiological, and hormonal changes (Dement, 2000).

Physiological Processes of the Sleep-Wake Cycle

As individuals, we do not consider the sleep-wake cycle until it becomes disturbed. There are many psychological factors such as our personality, depression, or stress that can interfere with sleep (Monroe, 1967; Taub, 1978; Taub, 1979; Verlander, Benedict, & Hanson, 1999). Sleep problems are more likely to be effected by physiological factors. There are three main physiological processes that directly affect the sleep-wake cycle: the autonomic nervous system, the homeostatic drive for sleep, and the circadian rhythms (Heath, 1998; Refinetti, 2000).

Autonomic Nervous System. The autonomic nervous system is a subcomponent of the peripheral nervous system. The autonomic nervous system relays impulses from the lungs, heart, stomach, pelvis, blood vessels and other organs through nerves to the brain. This stimulus controls the unconscious reflexes such as digestive functions, respiration, dilation of blood vessels, or size of the pupils. The autonomic nervous system is comprised of the parasympathetic and sympathetic systems (Streeten, 2009). During sleep there is increased parasympathetic functioning with a corresponding decrease in sympathetic functioning (Parmaggiani, 1994). Pamaggiani reported that electrical stimulation of the parasympathetic system resulted in behavioral signs of sleep in mammals such as: lower blood pressure, slower heart rate, and constriction of pupils.

The functioning of the sympathetic nervous system can be disruptive to sleep. Factors such as stress, worries, or increased hormonal activity may have a negative impact on sleep. Acute stress incidents or chronic stress situations can promote changes in heart rate variability which may lead to disturbed sleep (Hall et al., 2004). Worry and frustration associated with transitory difficulties in falling asleep may significantly impair the ability to sleep or remain asleep (Parmaggiani, 1994). Sleep cycles may also be impacted by

hormonal activity that disrupts the parasympathetic system or high adrenal activities that disrupts the sympathetic system (Lechin, van der Dijs, & Lechin, 2002). Any of these or other conditions may lead to sleep difficulties. These transient difficulties may develop into chronic insomnia when the sleep problems become behaviorally associated with the bedroom (Hauri, 1991).

In summary, the autonomic nervous system is an important component of initiating sleep and remaining asleep. Parmaggiani (1994) explains that the autonomic nervous system is designed to react immediately and can quickly impair sleep. Factors other than autonomic relaxation influence sleep readiness. It is common to fall asleep quickly even under stress or from being worried after several days without sleep. Thus, the homeostatic drive also impacts our ability to sleep.

Homeostatic Drive. Carskadon and Dement (1981) documented that the longer a person remains awake, the sleepier he becomes. Additionally, sleep deprivation is followed by shorter sleep onset and quicker entry into deep sleep (Roehrs, Carskadon, Dement, & Roth, 2000). Although the mechanisms that regulate the need of sleep at the cellular level are largely unknown, one physiological reason for this may be the accumulation of adenosine in the body. The normal metabolic processes of the body break down adenosine monophosphate (AMP) into adenosine. Adenosine, a neuromodulator inhibitor, may play a key role in falling asleep. It is found in higher concentrations when adults are awake than when asleep. It also accumulates in the brain during prolonged sleeplessness. Studies have found that treatments with adenosine promote sleep and decrease wakefulness (Porkka-Heiskanen, 1999). Sleep allows the body to return to a lower level of adenosine and therefore increase alertness.

A second possible physiological reason of sleepiness is the hormone prostaglandin. This hormone has been identified as a major factor in the feeling of sleepiness following an extended period of wakefulness (Ram et al., 1997; Scamel et al., 1998). Prostaglandin (PG) D₂ is the major prostanoid in the brain. It has been identified as a sleep-promoting substance in rats, mice, monkeys, and possibly humans (Hayaishi & Urade, 2002). Prostaglandins stimulate certain neurons that inhibit the arousal response of hypothalamic cells (Scamel et al., 1998). Hayaishi (1999) found that when PGDS, the enzyme that processes PGD₂ in the brain, was inhibited, both REM and slow-wave sleep were significantly reduced. This indicates that PGDS is a key enzyme in sleep regulation. Researchers have found that as part of this system, the orexin neurons located in the lateral hypothalamus, excites arousal regions during wakefulness, reducing drowsiness (Saper, Caqno, & Scammell, 2005). All healthy people produce prostaglandins throughout their bodies. This hormone is a byproduct of the immune system. Therefore, there is an increase in production of prostaglandins when a person is ill, which results in increased sleepiness.

Circadian Rhythms. The movement of the earth through space provides all living organisms with a variety of environmental stimuli that follow a rhythmic pattern. The French scientist Jean-Jacques d'Ortous de Mairan first identified the circadian cycle through the movement of plant leaves in the eighteenth century. Humans have a number of biological rhythms that generally occur in a consistent time pattern. Some biological functions follow an annual pattern such as male testosterone secretion or a monthly pattern such as the female's menstrual cycle (Parlee, 1982). Many human cycles follow an approximately 24 hour cycle. These are referred to as circadian rhythms. The term "circadian" was coined by Franz Halberg. He combined the Latin *circa*, "around", and

diem or *dies*, “day”, meaning literally “approximately one day.” Research indicates that the human sleep-wake cycle is timed by internal rhythms originating in the suprachiasmatic nuclei. Research on circadian sleep disorders indicates that circadian rhythms and sleep-wake cycles are closely integrated, but each are regulated differently (Dijk & Lockley, 2002).

Stephan and Zucker (1972) found that the destruction of the bilaterally paired suprachiasmatic nuclei in the anterior portion of the hypothalamus in rats caused a loss of daily biological rhythms. Further animal studies determined that the suprachiasmatic nuclei is the primary physical element in the circadian rhythm. When the suprachiasmatic nuclei in hamsters with a 20 hour circadian rhythm were transplanted into hamsters with 24 hour circadian rhythms, the receiving hamsters then had a 20 hour rhythm. Research has found that the converse was also true (Ralph, Foster, Davis, & Menaker, 1990). This strongly indicates that the suprachiasmatic nuclei are an endogenous component of the circadian rhythm.

The other components of the sleep-wake cycle include the external stimuli or *zeitgebers*, which is a German word for “time-givers.” *Zeitgebers* are environmental clues that allow biological systems to more accurately follow the 24 hour cycle of a day. Research, on rodents (Groos & Hendricks, 1982; Inouye & Kawamura, 1979), found that disabling the suprachiasmatic nuclei resulted in an extension of the circadian rhythm to 25 hours rather than the customary 24 hours. Research found that placing humans in an environment devoid of all environmental clues also resulted in a 25 hour cycle (Moore-Ede, Sulzman, & Fuller, 1982). This indicates that isolation from environmental clues or disabling the suprachiasmatic nuclei results in the organism reverting to a 25 hour sleep wake cycle, called a free-running rhythm. Some environmental factors may act as

zeitgebers such as exercise (Youngstedt, Kripke, & Elliot, 1990) or noise, meals, and temperature (Refinetti, 2000). The zeitgeber that consistently influences the circadian rhythm is bright light (Ando, Kripke, Cole, & Elliot, 1999; Boivin, Duffy, Kronauer, & Czeisler, 1994; Daurat et al., 1993; Duffy, Kronauer, & Czeisler, 1996; Lack & Wright, 1993; Trinder, Armstrong, O'Brien, Luke, & Martin, 1996). The rhythm of daylight allows organisms to anticipate and prepare for precise and regular environmental changes.

Van Cauter and Turek (2001) detail the organization of the mammalian circadian system. The suprachiasmatic nucleus (SCN) receives light from the retina by two pathways. The retinohypothalamic tract, which is a nerve bundle extending from the nonvisual photoreceptors in the retina of the eye, relays light messages to the SCN using glutamatergic neurotransmitters. Refinetti and Menaker (1992) demonstrated that damage to the retinohypothalamic track resulted in free-running circadian rhythms that are not affected by light. Retinal information also goes to the SCN from the intergeniculate leaflet of the thalamus. The light or photic information received by SCN is transmitted to the pineal gland. The pineal gland secretes the hormone melatonin. Melatonin is secreted only during dark periods and has sedative properties. Melatonin is also absorbed by the SCN which exerts phase-setting effects on the circadian rhythm. Thus, the circadian system consists of entrainment pathways or pacemakers. The entrainment pathway begins with light in the retinohypothalamic tract, informs the SCN, and then to the hypothalamus, midline thalamus, and the basal forebrain. The circadian system organizes the endocrine functions, psychomotor functions, and sleep-wake cycle on a time-based schedule (Moore, 1997).

Sleep Habits and Difficulties in Adolescence

Sleep Duration Among Adolescents. Adolescents and young adults get insufficient sleep which likely impacts important areas and performance in their lives (Carskadon, 2000; Carskadon et al., 1979; Pelay et al., 1988; Wolfson et al., 1998). Additionally, most adolescents do not realize the importance of sleep, nor the basic steps they can practice to improve the quantity and/or quality of sleep (Brown et al., 2002; Hicks et al., 1999).

Popular consensus has been that eight hours is the basic sleep requirement. Hutchison (2003) states that sleep-needs do not decline as humans age from toddlers to adolescents. The optimal amount of sleep for adolescents is about 9 hours or more each night (National Sleep Foundation, 2011; Carskadon, 2002). The need for such a large amount of sleep time is mostly ignored by teenagers (Carskadon, 2002; Carskadon et al., 1987). Wolfson and Carskadon (1998) found that adolescents in the United States average seven hours, 42 minutes at age 13, which decreased to seven hours, four minutes by the age of 19. A later study of high school students found the average sleep during the week was 6.7 hours followed by an average of 7.7 hours on the weekends (Eliasson, Eliasson, King, Gould, & Eliasson, 2002). There appears to be a trend toward less sleep among adolescents. From 1969 to 1989, the average time of sleep decreased from 7.5 to 6.5 hours nightly (Hicks et al., 1991). Although sleep duration seems to be decreasing, adolescents may need and even desire more sleep. High school students expressed a desire for 1.7 more hours of sleep during the school week (Strauch & Meier, 1988). Possibly due to biological and social factors, adolescents tend to go to bed later and maintain an early rise time which actually reduces the total sleep time (Banks & Dinges, 2007; Hicks et al., 1991). The most recent hypothesis is that neurological changes in the

brain such as synaptic pruning is related to increased sleepiness experienced by adolescents (Campbell, Higgins, Trinidad, Richardson, & Feinberg, 2007).

Sleep phase delay, in addition to insufficient sleep, may be a major factor in adolescent sleepiness. Although sleep phase delay is generally unrecognized, it is a normal and frequent occurrence for adolescents (Gibson et al., 2006).

Social factors certainly include the early start schedules for most public schools. School schedules requiring early morning start times may be related to sleep deprivation and daytime sleepiness. Teenagers may have difficulty adjusting to early school start times due to biological systems that control sleep as well as psychosocial influences (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998). In addition to this “normal” sleep loss, 30% or more of young adults report frequent sleep difficulties (Brown et al., 2001; Coren, 1994; Lack, 1986).

Reduced time and quality of sleep may affect a high school student’s classroom grades. Wolfson and Carskadon (1998) completed a survey of more than 3,000 high school students and found that academically low performing students (C’s, D’s, and F’s) slept about 25 minutes less per night and went to bed about 40 minutes later than students who reported grades of A’s and B’s. More recent studies have reported linear correlations between sleep time and grades (Drake et al., 2003).

Other academic markers are also affected by lack of sleep. Markers include tardiness (Dahl, 1996), absences (Roberts, Roberts, & Chen, 2001), falling asleep in class, and mental lapses (Dahl, 1996). Taras and Potts-Demea (2005) reviewed studies and provided a conclusion that the preponderance of the literature recognizes the detrimental effects of sleep disorders. They added that the major effects of sleep disorders

are not noticed by many primary care providers, school health professionals, and educators.

Sleep Phase Delay. In addition to insufficient sleep, sleep phase delay is an important factor in adolescents' feelings of sleepiness (Gibson et al., 2006). Delayed sleep-phase syndrome (DSPS) is also known as delayed sleep-phase disorder (DSPD) or delayed sleep-phase type (DSPT). It is a sleep disorder caused by abnormalities of the circadian rhythm. DSPT symptoms may include chronic disorders of the timing of sleep, core body temperature, periods of alertness, hormonal changes, and changes in other daily rhythms relative to societal norms. People with DSPS tend to fall asleep some hours after midnight and have difficulty waking up in the morning (Dagan & Eisenstein, 1999). Researchers (LeBlanc et al., 1999) reported that the symptom of delayed sleep onset is common in adolescents; but true DSPS that meets the full ICSD criteria is less common than documented in previous studies. Their study found an upper limit of DSPS prevalence to be approximately 1.3% of the population. Brown and colleagues found by self-report, a sample of United States college students reported a higher rate of DSPS (11.5%) than the general population (Brown, Buboltz, & Soper, 2001). Gibson and colleagues (Gibson et al., 2006) reported that morning sleepiness, particularly between eight and 10 a.m., was common among their participants. A significant proportion of their subjects reported they felt tired in the mornings, had difficulty waking, and were tardy. The participants went to bed later on weekends, which continued the sleep phase delay. The behaviors found in this study may be related to the effects of sleep phase delay and to age appropriate changes in circadian rhythms (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998; Carskadon, Acebo, & Jenni, 2004). This may indicate that due to biological conditions of changes in circadian rhythms, adolescents are often not

ready to function early in the morning. Those students who continued to feel sleepy between 10 a.m. and noon exhibited significantly more performance problems at school.

Physiological Effects. Insufficient sleep possibly causes a wide range of physical, cognitive, emotional, and academic difficulties. Correlations between physical conditions and lack of sleep include increased type 2 diabetes (Gottlieb et al., 2005), brain damage because of retardation of cell repairing enzymes (Seigel, 2003), and increased activity of the Hypothalamic, pituitary, adrenal glands. The hypothalamic, pituitary, and adrenal glands regulates stress and body functions such as mood, sex, digestion, the immune system, or energy usage while depressing the growth of hormones (Vgontzas et al., 1999). A more recent study of otherwise healthy adults who experienced reduced sleep suffered reduced endocrine functioning, metabolic problems, and impaired inflammatory responses. This suggests that loss of sleep produces an unhealthy physiology (Banks & Dinges, 2007).

The physical changes associated with sleep loss include impairment in functioning that may lead the person to be at higher risk to hurt themselves. Researchers found that acute sleepiness in car drivers significantly increased the risk of fatal car crashes (Connor et al., 2002). In the United States, drowsiness or fatigue is a principle cause in at least 100,000 traffic crashes annually. Fatigue and sleep loss may be a major cause of lapses in attention, reduced reaction time, and the self-evaluation of performance which indicates that drivers are not able to monitor their abilities (Phillip et al., 2003). Additionally, the effects of alcohol are heightened by sleepiness or loss of sleep. Even small amounts of alcohol to an adolescent who is sleepy may result in greater risk of injury (Roehrs, Beare, Zorick, & Roth, 1994).

Cognitive Effects. The effects of poor sleep habits on cognitive abilities have been examined in many clinical studies. Hicks & Gilliland (1981) studied the impact of mild but chronic sleep deprivation on the attention and coordination of college students. Their results suggested that habitually short sleepers, students who slept six or less hours per night, had more attention and coordination difficulties than students who habitually slept longer than nine hours. Another study expanded on this to explore students' higher cognitive functioning skills. Randazzo and colleagues found subjects who slept for five hours, one night out of the week, exhibited impaired cognitive functioning. The impairments were in verbal creativity, abstract thinking, and higher cognitive functioning (Randazzo, Muehlbach, Schweitzer, & Walsh, 1998). Alhola and Polo-Kantola (2007) found partial sleep deprivation significantly impaired attention and working memory. Partial sleep deprivation also had a detrimental effect on long-term memory and decision-making, attention, and vigilance. Studies have found that simply reducing the amount of sleep below an individual's usual time in bed has been shown to cause a range of neurobehavioral deficits, including lapses of attention, slowed working memory, reduced cognitive throughput, depressed mood, and perseveration of thought (Banks & Dinges, 2007). Total sleep deprivation was found to impair attention, working memory, long-term memory, and decision making (Alhola & Polo-Kantola, 2007), critical thinking, concentrating, and attending to relevant stimuli (Pilcher & Walters, 1997). Banks and Dinges (2007) went on to assert that several days of just partial sleep loss results in an accumulation of neurobehavioral deficits. Several consecutive nights of seven or less hours of sleep may result in significant cognitive dysfunction that resembles severe acute total sleep deprivation.

REM Sleep and Learning. Shortened sleep results in the loss of Rapid Eye Movement Sleep (REM). The last four hours of an eight hour sleep cycle has the longest REM sleep. Research found that the REM sleep stage plays a vital role in storing information learned during the day into long-term memory (Karni et al., 1994; Ohayon, Caulet, Philip, Guilleminault, & Priest, 1997; Smith & Lapp, 1991).

DeKoninck (1989) demonstrated that there is a positive correlation between increased REM sleep and increased learning efficiency. The study used students who were taking a 6-week French immersion course. Polysomnographic readings were gathered on the participants two weeks prior to beginning the class, again mid-way through the course, and a third set of readings approximately one month after completion of the course. Students who demonstrated increased REM sleep during and immediately after the intensive learning sessions recalled more of the information with fewer errors than the students without increases in REM sleep. Further analysis of other sleep stages found that increased language learning efficiency was associated only with REM sleep (DeKoninck et al., 1989).

Smith and Lapp (1991) explored the relationship of REM sleep to important learning events. Careful study of students under experimental conditions found that following exam periods, students experienced a greater number of REMs and a greater density of REMs than their individual baseline measurements. The more frequency and greater density REM sleep, continued for three to five days following the examinations (Lapp & Smith, 1991).

REM sleep also affects learning and developing visual-perceptual skills such as sports, visual arts, or performing arts. Karni, Tanne, Rubenstein, Askenasy, and Sagi (1994) investigated the influence of sleep in attaining new skills in young adults. Baseline

data was first gathered on each subject in a sleep laboratory. After that the students were deprived of SWS or REM sleep for two nights, and then the students were allowed uninterrupted sleep for two nights. The subjects were allowed off for one week, and then the procedure was repeated. The second week was accompanied by an experimental procedure of learning a novel visual stimulus detection skill. The skill required identifying three shapes whose orientation was different from other objects in the visual field. Participants with SWS stage deprivation improved in their ability to detect the newly learned skill of identifying the target stimulus. However, during SWS deprivation the participants did not perform previously learned skills as well. When the participants were deprived of REM sleep, they did not improve in their ability to detect the newly learned skill of identifying the target stimulus; however REM deprivation did not reduce their performance of previously learned skills. These results suggest that during REM sleep there is a neurophysiological activity that facilitates learning new skills, whereas there is a different neurophysiological activity during SWS that facilitates performance of previously learned skills (Karni et al., 1991).

These studies indicate that sleep impacts learning. Poor sleep prior to a test will most likely result in depressed results (DeKoninck et al., 1989; Pilcher & Walters, 1997). Additional studies provide evidence that sleep irregularities are as detrimental as sleep reduction to cognitive and emotional functioning (Taub, 1978; Taub, 1979; Taub, 1980; Taub & Berger, 1974; Taub & Berger, 1976; Taub et al., 1976).

Emotional and Behavioral Effects. Poor sleep duration or sleep quality interferes with the emotional and behavioral functioning of young people. In college students, poor sleep quality is related to feelings of tension, anger, emotional imbalance, depression (Picher & Walters, 1997), and also to drug and alcohol use (Jean-Louis et al., 1998). It

seems that even small but chronic sleep losses are related to mood or behavioral problems. As little as two hours of variation in the sleep-wake schedule, even with eight hours of sleep, has been found to result in greater incidence of depression, lower sociability, and attention and concentration difficulties (Taub & Berger, 1974). Morrison, McGee, and Stanton (1992) found that adolescents who reported sleep problems showed more anxiety, depression, and inattentive behavior than those who had no, or occasional, sleep problems. This study also found that adolescents with sleep problems reported significantly more conduct disorder behavior. A follow-up eight years later found that decreased sleep time among secondary school age children was significantly associated with teacher reports of aggressive and delinquent behavior and social and attention problems (Aronren, Paavonene, Fjalberg, Soininen, & Torronen, 2000). The above described moods and behaviors in a school setting represent unacceptable behavior that may result in adverse consequences for the student such as poor peer relations, academic difficulties, disciplinary action, and misdiagnosis for school related behavioral or academic problems. R. E. Dahl (1996) found that, at the time, there was very little hard data concerning a relationship between the cognitive functioning of children and the effects of poor sleep. It was Dahl's opinion that the trend of observational and clinical studies indicated that symptoms such as attention difficulties, irritability, frustration, emotionality that are often times diagnosed as Attention Deficit Hyperactivity Disorder may actually be a result of poor sleep.

Sleep and Physical Health. Researchers are finding a relationship between sleep duration and important health factors. Recent studies indicate that length of sleep is linked to obesity, diabetes, and coronary problems.

Obesity is currently a growing concern among the general population as well as epidemiologists. Children and adolescents are of particular concern. There is a growing body of research that is making a link between shortened sleep times and obesity or increased body-mass index (BMI). Marshall, Glozier, and Grunstein (2008) reviewed scientific studies that investigated the relationship between habitual sleep duration and obesity. They found a clear pattern, among the pediatric populations, of a relationship between shorter sleep durations and obesity. They emphasized that there was not yet enough evidence to give public health advice about sleep duration being a modifiable risk factor for obesity. In the same vein, Cauter and Knutson (2008), reviewed laboratory evidence and reviews of cross-sectional epidemiological studies point to a possible role of decreased sleep duration in the current epidemic of obesity. Kohatsu et al. (2006) acknowledged that there is a growing body of evidence associated with short sleep duration and obesity or BMI. They conducted a Cohort Study in 1999-2004. The participants were employed adults in rural southeastern Iowa. Kohatsu et al. (2006) reported an association between short sleep duration and higher BMI, which was consistent with the relationship found in other settings.

In addition to obesity, the effect of decreased sleep on diabetes mellitus (DM) has drawn interest from researchers. Initial findings indicate that reduced sleep may contribute to diabetes mellitus. Gottlieb et al. (2005) reported that experimental sleep restriction is correlated with diabetes mellitus (DM) and impaired glucose tolerance (IGT). They conducted a study to explore the metabolic effects of habitual sleep restriction on IGT. The study of over 1400 adults compared the relation of sleep time to IGT. The study concluded that sleep duration of six hours or less, as well as nine hours or more, is associated with an increased prevalence of diabetes mellitus and impaired

glucose tolerance. This effect was also present after withdrawing subjects suffering from insomnia which may indicate that voluntary sleep restriction may contribute to increased diabetes mellitus within the general population. Knutson and colleagues examined whether short or poor sleep is associated with glycemic control in African Americans with type 2 diabetes mellitus. Their cross-sectional study of 161 participants assessed glycemic control by measurement of hemoglobin A (HbA), sleep quality, and perceived sleep debt. They found that sleep duration and quality were significant predictors of HbA, a key marker of glycemic control. The authors added that their findings and the findings of other studies indicate there is a relationship between sleep loss and an increased diabetes risk (Knutson, Ryden, Mander, & Van Cauter, 2006).

Researchers are also beginning to find a link between inadequate sleep and coronary problems. There are indications that reduced sleep is associated with coronary disease and increased coronary artery calcification. Najib T. Avas and colleagues designed a study to investigate the relationship between decreased sleep duration (from self-reports) and an increased risk of coronary events.

The large, longitudinal study followed a cohort of over 71,000 middle-aged female health professionals from 1986 to 1996. The study assessed the relationship between self-reported sleep and the duration and incident of coronary heart disease. The findings indicated that short and long self-reported sleep durations were independently associated with a modestly increased risk of coronary events (Avas et al., 2003). A more recent study investigated the relationship between coronary artery calcification and both objective and subjective measures of sleep duration. This study gathered data on nearly 500 healthy middle-aged adults over a 15 year time span. The study found that longer measured sleep was associated with lower incidents of coronary artery calcification.

These findings were independent of other environmental mediators and confounders such as age, sex, race, education, apnea risk, smoking status, lipids, blood pressure, body mass index, diabetes, inflammatory markers, alcohol consumption, depression, hostility, and self-reported medical conditions. The authors found that participants in the study who slept one hour more each night than other participants had a lower incidence of coronary artery calcification (King et al., 2008). These findings fit well with an earlier study by Peker, Carlson and Hedner (2006). The seven-year study targeted 300 snorers and found artery disease in 16.2% of the 105 participants identified with obstructive sleep apnea, whereas only 5.4% of the snorers without obstructive sleep apnea had coronary artery disease. The authors concluded middle-aged adults with sleep apnea are at high risk for developing coronary artery disease.

Sleep and School Performance. Millman (2005), in an extensive review of the literature, reported that studies strongly suggest that either shortened sleep duration or irregular sleep schedules are strongly related to poor school performance. A small study with self-reporting college students indicated that short sleepers (≤ 6 hours sleep) reported significantly lower overall grade point averages than students sleeping more than nine hours per night (Kelly, Kelly, & Clanton, 2001). Wolfson and Carskadon (1998) completed a survey of 3,120 high school students in New England using the School Sleep Habits Survey. The students who reported regular sleep/wake schedules and longer sleep duration reported better grades. The students who earned B's or better grades reported longer sleep times and earlier school week bedtimes. The B or better students were significantly better than the C or lower students. High performing students with grades of A's and B's also went to bed earlier and rose earlier on weekends than poor performing students. Students performing worse academically reported larger differences

in weekday/weekend schedules than high performing students. Slightly older students attending college exhibit poor critical thinking skills after a night without sleep (Pilcher & Walters, 1997). Not only is there a correlation between sleep and performance, but also between the students' perception of self. A recent study of young adolescents found that students reporting difficulty getting up in the mornings also reported less motivation to do their best at school. Students reporting higher quality sleep and feeling well rested also reported a more positive image of themselves and feeling more receptive to teacher influence and higher motivation to be successful at school (Meijer, Habekothé, & Van Den Wittenboer, 2000).

Scientific studies have established that for secondary school students shortened sleep duration and chaotic sleep schedules are related to overall poor school performance (Wolfson & Carskadon, 2003). Conversely, students with higher grades report more total sleep time and consistent sleep habits from weekday to weekend (Wolfson & Carskadon, 1998). Intervention attempts include a large study in Minnesota which delayed school start time. The results of postponing school start times were: increased sleep time during the weekdays, improved school attendance, and fewer drop-outs (Wahlstrom, Davison, Choi, & Ross, 2001). Epstein and colleagues (Epstein, Chillag, & Lavie, 1998) also studied the effects of early start times in schools. Their study compared high school students who started school at 7:15 a.m. to students who began at 8:00 a.m. Results were that the early risers complained of daytime sleepiness, fatigue, falling asleep in class, and difficulty concentrating and attending. Based on this and other studies, Minnesota's Minneapolis Public Schools changed their high school start time from 7:15 a.m. to 8:40 a.m., beginning with the 1997-1998 school year. The Center for Applied Research and Educational Improvement at the University of Minnesota examined the effects of later

start-time over a year long study (Wahlstrom, Davison, Choi, & Ross, 2001). They studied attendance records and results of the School Sleep Habits Survey. The study compared data from 1995-96 to data from 1999-2000, the year when the later start-times were initiated. They found that students' attendance increased percentage of students continuously enrolled in the same district increased, and the total number of drop-outs decreased. There was no significant change in responses to the School Sleep Habits Survey over the same period of time. This indicated that students did not change their time to go to bed on weekdays or weekends. However, with later rise times the Minneapolis students reported an average of 60 minutes more of sleep each night than high school students with conventional schedules.

Sleep Hygiene. The interaction of sleep hygiene and adolescents' sleep has received some attention. The few studies that have explored the use of sleep hygiene training have resulted in mixed results. Some studies indicated measurable improvement in quality and quantity of sleep. Lebourgeois and colleagues conducted a cross-cultural study of adolescent differences in sleep hygiene and sleep quality. The participants were students from Rome, Italy, and Southern Mississippi. The students completed the Adolescent Sleep-Wake Scale and the Adolescent Sleep Hygiene Scale. The study found significant cultural differences in sleep quality and sleep hygiene practices and that sleep hygiene practices and sleep quality were related (Lebourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2004). A year later Lebourgeois and colleagues published further data from that study that indicated cross-cultural differences in sleep quality, for the most part, were due to differences in sleep-hygiene practices and that sleep hygiene practices were an important predictor of sleep quality in both the Italian and American samples of adolescents. It was felt that this supported the implementation and evaluation of

educational programs on good sleep hygiene practices (Lebourgeois et al., 2005). These findings were similar to those found by Brown (2002). He studied the impact of a psychoeducational training program concerning sleep hygiene for college students. Students who took part in the sleep hygiene training demonstrated, at the six-week post treatment, significantly improved sleep hygiene practices, fewer naps, reduced caffeine use, greater physical comfort and relaxation at bedtime, greater sleep efficiency, shorter sleep latency, and less medication use (Brown, 2002). Conversely, a study of 58 Brazilian adolescents in a school-based sleep hygiene program showed a reduction in their index of sleep irregularity, their sleep latency decreased and their nap-wake up schedule advanced. There was no significant change in the students' sleep quality or daytime sleepiness. The authors judged that the program was effective in reducing sleep irregularity and latency and advancing nap awaking. They recommended that the program be improved and extended to a larger sample in hopes of achieving better results (Sousa, Araujo, & Azevaedo, 2007).

Summary of Literature Review

The most important literature for this research involves the effects of sleep duration and sleep quality on the functioning of adolescents. Studies have found that college students exhibit a high prevalence of poor sleep quality and inconsistent sleep habits (Brown et al., 2001; Lack, 1986; Pilcher et al., 1997). These patterns have also been found within the high school population. Wolfson and Carskadon (1998) reported that high school students, on average, sleep less than eight hours per night when their bodies actually need nine hours each night. Additionally, more than one quarter stated they slept only 6.5 hours during the school week. This lack of sleep resulted in the findings of Strauch and Meier (1988) that the wish for more sleep was very pronounced,

varying between 54.3% and 74.5% across the years and the desired sleep duration of these subjects was 1.7 hours longer than their current sleep during the school week.

Poor sleep quality has been linked with serious effects on both cognitive and emotional performance. Total sleep deprivation was found to impair attention, working memory, long-term memory, and decision making (Alhola & Polo-Kantola, 2007), critical thinking, concentrating, and attending to relevant stimuli (Pilcher & Walters, 1997), increased emotional imbalance, feelings of tension, anger, depression (Pilcher et al., 1997), drug and alcohol use (Jean-Louis et al., 1998), and difficulties learning new material (DeKoninck et al., 1989; Lack, 1986; Pilcher & Walters, 1987; Ralph et al., 1990). Banks and Dinges (2007) reported that neurobehavioral deficits accumulate when subjects experience even partial sleep loss. Chronic sleep of less than seven hours per night causes significant daytime cognitive dysfunction similar to acute sleep deprivation. Also, sleep-wake variations in a schedule of only two hours result in increased incidence of depression, lower sociability and significant attention and concentration problems (Taub & Berger, 1974).

Despite the potential difficulties of poor sleep quality and inconsistent sleep habits, there are few studies exploring interventions for improving sleep habits or quality. Brown (2003) found that the use of the Sleep Treatment Education Program for Students (STEPS) lowered sleep disturbance scores, shortened sleep onset times, and reduced the use of sleep medication for the treatment group. Meta-analytic studies with various non-student populations strongly supports the efficacy of psychoeducational interventions to improve overall sleep quality, which includes sleep latency, subjective sleep satisfaction, sleep efficiency and sleep duration (Morin et al., 1994; Murtagh & Greenwood, 1995; Pilcher & Huffcutt, 1996). Psychoeducational interventions such as sleep hygiene

instructions have shown to be as effective as more time intensive, in-depth psychological interventions or sleep medication in long term studies (Morin et al., 1994; Murtagh & Greenwood, 1995; Pilcher & Huffcutt, 1996).

Hypotheses

As a result of this research, the Sleep Treatment and Education Program for Students (STEPS) was used to determine whether teaching adolescent high school students about the importance of sleep, sleep hygiene knowledge, and stimulus control instructions would result in better sleep hygiene practices, more consistent sleep habits and improved sleep quality. Based on the above research, the following hypotheses were examined.

The hypotheses were designed to explore two major areas of interest. Hypotheses 1A and B through 4A and B gathered survey data to describe actual sleep practices, sleep quality, general health, and physical activity. The second major area of interest, hypotheses five through eight, examined the impact of the psychoeducational intervention on the following outcomes: sleep quality, subjective sleep quality, sleep duration, knowledge of sleep hygiene behaviors, and better sleep hygiene practices.

Hypothesis 1A

There will be a significant positive relationship between sleep duration and the Grade Point Average from the previous semester.

Hypothesis 1B

There will be a significant negative relationship between sleep quality and the Grade Point Average from the previous semester.

Hypothesis 2A

There will be a significant positive relationship between sleep duration and general physical health for the previous month.

Hypothesis 2B

There will be a significant negative relationship between sleep quality and general physical health for the previous month.

Hypothesis 3A

There will be a significant positive relationship between sleep duration and general mental health for the previous month.

Hypothesis 3B

There will be a significant negative relationship between sleep quality and general mental health for the previous month.

Hypothesis 4A

There will be a significant positive relationship between sleep duration and school attendance in the previous semester.

Hypothesis 4B

There will be a significant negative relationship between sleep quality and school attendance in the previous semester.

Hypothesis 5

There will be significantly longer overall sleep duration among students in the treatment group compared to students in the control group at post-test.

Hypothesis 6

There will be significantly higher subjective sleep quality among students in the treatment group compared to students in the control group at post-test.

Hypothesis 7

There will be significantly improved sleep hygiene knowledge among students in the treatment group compared to students in the control group at post-test.

Hypothesis 8

There will be significantly improved sleep hygiene practices for students in the treatment group compared to students in the control group at post-test.

CHAPTER TWO

METHODS

Participants

Participants for this study were randomly selected from a medium size high school (grades 9 through 12) in the Southern United States. The final sample consisted of 441 high school students. Two participants did not provide demographic information of grade placement, sex, age, race, or GPA. Grade placement of the participants included the following: 96 in 9th (21.7%), 67 in 10th (15.1%), 114 in 11th (25.7%), and 164 in 12th (37.0%) grade. The sample was comprised of 192 males (43.3%) and 249 females (56.2%) with a mean age of 16.83 years ($SD = 1.3$). The ethnic makeup was 42.2% African-American, 50.8% Caucasian, 2.5% Hispanic, 2.5% Asian-American, and 2% other. The average GPA of the participants was 2.88 ($SD = .76$). The Control and Treatment groups were chosen from the total sample of 441 participants.

Control Group

The control group consisted of 76 participants who were randomly selected from the sample of 441 participants. Grade placements of the participants included the following: 11 in 9th (14.5%), 14 in 10th (18.45%), 20 in 11th (26.3%), and 31 in 12th (40.8%) grade. The control group included 31 males (40.8%) and 45 females (59.2%) with an average age of 17.01 ($SD = 1.26$). The ethnic makeup was 47.4% African-

American, 46.1% Caucasian, 1.3% Hispanic, 0% Asian-American, and 5.3% other. The average GPA was 2.94 (SD = .72).

Treatment Group

The treatment group also consisted of 76 participants who were randomly selected from the sample of 441 participants. Grade placements of the participants included the following: 20 in 9th (26.3%), 25 in 11th (32.9%), and 31 in 12th (40.8%) grade. Due to random selection, no 10th grade class was selected from the larger group to participate in the treatment phase. The treatment group included 28 males (36.8%) and 48 females (63.2%) with an average age of 16.95 years (SD = 1.49). The ethnic makeup was 51.3% African-American, 43.4 Caucasian, and 5.3% Hispanic. There were no participants in the treatment group that self-reported as Asian-American or Other. The average GPA of the treatment group was 2.64 (SD = .63).

Instruments

The following five instruments were used in this study: (1) The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36v2), (2) Sleep Hygiene Awareness and Practice Scale, (3) Sleep Quality Index, (4) Demographic Survey, and (5) Educational Markers.

The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36v2)

Ware and Sherbourne (1992) described the Medical Outcomes Study Short-Form Health Survey (SF-36) as a measure of overall health status. The instrument's original purpose was to serve as a general measure of physical and mental health to assist in clinical practice and health policy evaluations. The SF-36 has evolved into an assessment of specific diseases and the benefits of various treatments (Turner-Bowker, Bartley, & Ware, 2002; McHorney, Ware, Lu, & Sherbourne, 1994; Ware, Keller,

Gandek, Brazier, & Sullivan, 1995). This instrument has been improved, updated and renormed as the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36v2) which was used for this study. Due to the complexity of scoring, the SF-36v2, the Qualitymetric Health Outcomes Scoring Software 2.0 (Saris-Baglama et al., 2007) was used to score the instrument.

The SF-36v2 is a 36-item self-report scale intended for people 14 years or older. It is composed of eight scales, with each scale being composed of two to ten items. There are two component summary scales (Ware et al., 2000). The scales of the SF-36 are Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role-Emotional (RE), and Mental Health (MH). The PF scale measures the degree of limitations in performing physical activities. Low scores indicate the respondent is very limited in performing all physical activities, such as self-hygiene, while high scores indicate the respondent performs all types of physical activities without limitations due to physical health. A sample item would be: "Walking more than one mile." The participant would answer, on a three point scale, ranging from "A Lot" of limitations to "None."

The RP scale assesses the degree of limitations in usual role activities over the past four weeks due to physical health problems. Low scores are associated with problems in work or other daily activities as a result of physical health, while high scores indicate no problems with work or daily activity. A sample item would be: "Accomplish less than you would like." The participant answers on a five point scale ranging from "All of the Time" to "None of the Time."

The BP scale measures the occurrence of pain and limitations on activities as a result of pain. Low scores indicate very severe and extremely limiting pain, while high

scores indicate no pain or limitations due to pain. This scale is comprised of only two items. One asks: “How much bodily pain have you had during the past four weeks?” It is answered on a six point scale ranging from “None” to “Very Severe.” The second item is: “During the past four weeks, how much did pain interfere with your normal work?” It is answered on a five point scale ranging from “Not At All” to “Extremely.” The GH scale is an overall assessment of personal health. Low scores indicate poor health with the expectation of deterioration while high scores indicate a perception of excellent personal health. A sample item is: “I seem to get sick a little easier than other people.” This item is scored on a five point scale ranging from “Definitely True” to “Definitely False.”

The VT scales measure levels of energy or fatigue. Low scores indicate the individual feels tired and worn out all the time. High scores represent feelings of energy and pep all the time.

The SF scale measures the degree of limitations in social activities due to physical or emotional problems. Low scores denote severe and frequent interference with social activities due to physical or emotional problems, while high scores indicate normal social activities with no interference from physical or emotional problems. Two questions from this scale are: “Do you have a lot of energy?” and “Do you feel full of life?”. Responses are scored on a five point scale from 1 = “All of the Time” to 5 = “None of the Time.”

The RE scale measures the degree to which usual role activities was limited during the previous four weeks by emotional problems. Individuals with low scores experience problems with work and all daily activities while individuals with high scores experience no limitations in these areas.

The MH scale measures the level of psychological distress or well-being. Low scores are indicative of individuals that feel nervous and depressed, while high scores are

indicative of individuals that feel peaceful, happy, and calm all the time. An example of an item is: “Accomplish less than you would like.” Responses are scored on a five point scale ranging from 1 = “All of the Time” to 5 = “None of the Time.”

Two summary scores describe feelings and functioning in the physical and mental health realm. The Physical Component Summary (PCS) measure is obtained using scores from the PF, RP, BP, and GH scales (Ware et al., 2000). Each component has a mean of 50 and a standard deviation of 10 (Ware et al., 2007). Low scores on the PCS indicate poor self-care, physical, social, and role activities, severe bodily pain, frequent tiredness, and general poor health. High scores indicate feelings of well-being, high energy level, and excellent health with no physical limitations or disabilities.

The Mental Component Summary (MCS) measure is obtained using scores from the VT, SF, RE, and MH scales (Ware et al., 2000). Low scores on the MCS are indicative of psychological distress, social and role disability due to emotional problems. High scores indicate good overall mental health, with a positive affect, absence of psychological distress, and no limitations in social and role activities due to emotional problems.

Reliability of the SF-36v2 has been demonstrated through studies done by its authors as well as other researchers over the years. Internal consistency reliability estimates for the two composite scores and eight scale scores range from a low of .82 (GH) to a high of .94 (PCS and RP). This is well within the reliability coefficient of .70 or better recommended by Nunnally and Bernstein (1994). Four other studies evaluated the reliability of the SF-36v2 and all reported Cronbach’s alpha coefficients exceeded the recommended minimum estimate of .70 (Jenkinson, Stewart-Brown, Peterson, &

Paice, 1999; Taft, Karlsson, & Sullivan, 2000; Han, Lee, Iwaya, Kataioka, & Kohzuki, 2004; an Razvi, Ingoe, McMillan, & Weaver, 2005).

Validity of the SF-36v2 was established through studies of construct validity, criterion validity, and content validity (Ware et al., 2007).

Construct validity was established by comparing the composite scores and scale scores of the SF-36v2 to the same items of the previous SF-36 Health Survey. The validity of the SF-36 Health Survey had been established by several studies which found evidence of content, concurrent, criterion, construct, and predictive validities (Garratt, Ruta, Abdalla, Buckingham, & Russell, 1993; Jenkinson, Coulter, & Wright, 1993; McHorney et al., 1994; Wagner et al., 1995; Ware, Snow, Kosinski, & Gandek, 1993; Ware et al., 1995). Scale validity and correlations with rotated principal components for the SF-36v2 Health Survey and the SF-36 Health Survey Standard Forms, based on the 1998 U.S. general population data, found that 74% of the total variance was explained by the scales (Ware et al., 2007).

Criterion validity describes how closely the measure corresponds to previously validated measures of the same idea or concept (Anastasi, 1988). To do this the authors studied both concurrent and predictive validity. The items of the SF-36v2 were compared to the information gathered from a sample of 11,000 participants gathered by QualityMetric using the DYNHA Computer Adaptive Health Assessments engine (Ware, Gandek, Sinclair, & Kosinski, 2004). The study found correlations for the eight health domain scales, ranging from .76 to .93 (Ware et al., 2007). Predictive validity was also found to be strong. Using data from the Medical Outcomes Study (MOS) and Medicare Health Outcomes Survey (HOS), a linear relationship between decreasing item scale scores and the occurrence of adverse events was found (Ware et al., 2007). This means

that as scale scores decrease, the respondents were more likely to experience decreased functioning in daily life functioning.

Content validity or the adequacy of the items to fully cover the universe of symptoms has been studied extensively (Nunnally et al., 1994). The SF-36v2 includes eight of the most frequently used health concepts (Ware et al., 2007). Within the PCS summary score, the PF, RP, and BP scales are the most valid for measuring physical health. Within the MCS summary scores, the MH, RE, and SF scales are the most valid for measuring mental health (Kravitz et al., R.L., 1992; McHorney et al., 1994; Ware et al., 1993; Ware et al., 1994; Ware, Keller, Gandek, Brazier, & Sullivan, 1995).

Sleep Hygiene Awareness and Practice Scale (SHAPS)

The Sleep Hygiene Awareness and Practice Scale (SHAPS) was developed by Lacks and Rotaert (1986) through a study comparing sleep hygiene of established insomniacs versus good sleepers. The instrument is composed of two parts. Part one measures awareness of sleep hygiene, part two measures the practice of sleep hygiene. The Sleep Hygiene Awareness section consists of 13 items designed to measure the participant's knowledge of the effect of specific activities on sleep. Respondents rate behaviors on a scale from one, indicating the behavior is very beneficial to sleep, to seven, indicating the behavior is very harmful to sleep. A rating of four indicates the respondent's belief that the behavior has a neutral effect on sleep. Responses are given one point if correct, two points if not answered, and three points if incorrect. For example, if the correct answer is that the behavior is disruptive to sleep; respondents rating from one through four are incorrect and receive three points. Ratings of five to seven are correct and receive one point. Items with behaviors beneficial to sleep use the

opposite scoring method. Total scores on this subscale range from 13 to 39. Higher scores indicate poorer sleep hygiene awareness.

The Practice section contains 19 items assessing the number of nights per week the respondent engages in activities known to promote or inhibit sleep (e.g., napping, evening exercise, regular afternoon exercise, etc.). Responses range from zero (never) to seven (daily). Items are given one point for each day of the activity. Total Hygiene Practice scores range from zero to 133. Higher scores indicate engagement in behaviors less conducive to good sleep hygiene (Lacks & Rotert, 1986).

Brown, Buboltz, and Soper (2002) completed a study to determine the internal and test-retest reliability of the SHAPS. Each section of the SHAPS has different scoring methods; therefore, internal reliability was measured for each section. The Sleep Hygiene Awareness section had good internal reliability (Cronbach's $\alpha = .78$), and the Sleep Hygiene Practices section had marginal internal reliability (Cronbach's $\alpha = .55$). The Sleep Hygiene Awareness section had good test-retest reliability ($r = .76, p < .001$), and the Sleep Hygiene Practices section had good test-retest reliability ($r = .74, p < .001$) (Brown, Buboltz, & Soper, 2002).

Brown et al., (2002) explained that the weak internal reliability of this instrument may not necessarily reflect poor psychometric quality, but rather that individual participants may report a mixture of good and bad sleep habits. Good test-retest reliability demonstrates that responses are stable over time and indicates the instrument may be used. The poor psychometric qualities of the Caffeine Knowledge Survey are such that it is not useful for this study.

Sleep Quality Index (SQI)

The Sleep Quality Index was developed by Urponen, Partinen, Vuori, and Hason (1991) as an eight-item self-report measure of general sleep quality and difficulties. Each item has three response options weighted 0, 1, or 2. The results may be used as a continuous score or as discrete categories. The sum of the items provides a general sleep quality score. The discrete categories are based on the total score: Good Sleep Quality = total scores of 0 to 1, Moderate Sleep Quality = scores of 2 to 8, and Poor Sleep Quality = scores of 9 to 16. The original authors reported an internal consistency of .74. The Cronbach's alpha for the current sample was .71. Urponen et al., (1991) supported the validity of the SQI by reporting a significant relationship between quality of sleep and subjective health.

Demographic Survey

The demographics survey consisted of ten general information questions, relating to age, gender, ethnicity, year in school, extracurricular activities, hours involved in extracurricular activities, employment status, hours of work, whether or not the person has sleep difficulties, and if he or she would like to have better sleep quality.

Educational Performance Markers

The educational performance markers are participants' grade point average, number of suspensions, and absences. This information was gathered from the high school records for each participant's previous school year.

Materials

The materials used in the experimental component of this study included two psychoeducational presentations: Sleep Treatment and Educational Program for Students, and Alcohol Prevention Presentation.

Sleep Treatment and Education Program for Students

The Sleep Treatment and Education Program for Students was originally developed by Brown, Buboltz, and Soper (2002). It included a 30-minute oral presentation, handouts with Sleep Hygiene Guidelines, Stimulus Control Instructions, and Substances with Caffeine. It was modified for use with high school students.

The lecture component lasted approximately 30 minutes and was presented in a group setting. The presentation began by explaining the purpose of the Sleep Treatment and Education Program. Handouts were distributed to all participants describing sleep difficulties in adolescents and young adults. The consequences of poor sleep hygiene were presented in a lecture. Handouts with this information was provided and reviewed. Handouts included the following sections: Sleep Hygiene Guidelines, Substances with Caffeine, and Stimulus Control Instructions.

The presentation was presented in the following order:

- An introduction that presented the need for sleep in the overall context of Maslow's hierarchy of needs (Maslow, 1970).
- The purpose of the presentation that introduced the need for increased amounts of sleep and improved sleep quality.
- Explanations of the amount of sleep needed and the consequences of limited sleep amounts.
- Description of the importance of good sleep duration and good sleep quality.
- Explanation of the importance of good sleep quality and the consequences of poor sleep quality.
- Description of the impact of poor sleep duration and poor sleep quality, including the loss of REM sleep and sleep phase delay.

- Description of detailed sleep hygiene methods to improve sleep duration and sleep quality.

The presenter provided the Sleep Hygiene Guidelines handout which included ten practical, individual behaviors that may either promote or inhibit sleep. The guidelines are a common part of most clinical sleep practices (Lacks, 1987) and receive substantial support from research (Morin et al., 1994; Murtagh & Greenwood, 1995). The guidelines included the more traditional sleep hygiene instructions (Lacks, 1987; Bootzin et al., 1991) which included recommendations such as (1) do not go to bed until drowsy, (2) do not take caffeine after 4 p.m., (3) exercise regularly except two hours before bedtime, (4) make your sleep environment conducive to sleep, and (5) to get regular morning sunlight or bright (250 lumens) artificial light.

The Substances with Caffeine handout lists common over-the-counter drugs, drinks, and food that contain caffeine such as over the counter medicines, coffee, colas, tea, sports drinks, chocolate, and diet pills. The handout specifies the amount of caffeine in each substance (Nehlig et al., 1992; Roehrs & Roth, 1997; Tiffin et al., 1995).

The Stimulus Control Instructions provides recommendations to reduce sleep problems. These are recommendations that are common to clinical practice (Lacks, 1987) and are empirically based activities to improve sleep quality (Morin et al., 1994; Morin & Wooten, 1996; Murtagh & Greenwood, 1995). These include (1) use the bed only for sleep not watching TV, reading, talking on the phone, etc.; (2) lie down in bed only when sleepy or ready for sleep; (3) establish a regular pre-sleep routine; and (4) if not asleep within 15 minutes, leave your bed and do something relaxing (Bootzin & Nicassion, 1991).

Alcohol Prevention Presentation

The Alcohol Prevention Presentation (APP) was the placebo program presented to the control group. The APP was designed to provide pertinent and useful information concerning drug use without contaminating the control group with information concerning sleep hygiene. The Alcohol Prevention Presentation for Students was developed by Methodist Children's Home. It included oral presentation, handouts with information about drugs, the effects of drugs on the human body, and methods to avoid their use. The oral presentation lasted approximately 30 minutes and was presented to the control participants in a group setting. The presentation began by explaining the purpose of APP. Descriptions were given of the prevalence of illegal drug use in adolescents and young adults, as well as the physical and emotional consequences of illegal drug use. Handouts were provided and reviewed, which included the following: Healthful Behavior and Wellness, Discuss Risk Factors (Meeks, Heit, & Page, 1995), and Review of Prevalence of Drug Use (OAS-SAMSHA, 2009).

The presentation was as outlined:

- Overview of unhealthy drug use and the prevalence of use today
- Review of risk factors
- Effects of stimulants
- Description of stimulants and examples
- Examples of stimulants
- Stimulants' effects on the body
- Effects of depressants
- Description of depressants and examples
- Examples of depressants effects on the body

- Effects of hallucinogens
- Description of hallucinogens and examples
- Examples of hallucinogens
- Hallucinogens' effects on the body
- Avoidance of unhealthy drug use

Procedures

This study was comprised of two parts. Part A gathered survey information from a sample of the total school population to assess the following information: (1) sleep duration, (2) sleep quality, (3) grade point average, (4) general physical health (5) general mental health, and (6) attendance. Part B measured the affect of a thirty minute psychoeducational presentation on sleep duration, sleep quality, sleep hygiene knowledge, and sleep hygiene practices.

Part A

The first group consisted of 441 participants, who were selected by randomly picking 37 of the possible English classes offered. All participants were informed by their teachers that a study would be done. The participants were given written descriptions of the study, Human Participant Consent forms to be signed by the participants' parents, and assent forms signed by the participants. The description of the study explained that participation in the study was voluntary. All teachers offered extra points for participation, but no other compensation was provided. All data was stored separately from consent forms to ensure anonymity. To assure anonymity of the participants, the following steps were used in the collection and collating of data:

- Human Participant Consent Forms were collected.

- Each student was assigned a unique number that did not correspond to other numbers such as Social Security, school ID, role book, etc.
- Information was retrieved from the school database and recorded under that student's unique number.
- Individual survey packets were encoded with the student's unique number and his or her name was written on a strip of paper stapled to the survey packet.
- The primary researcher distributed the survey packets by name along with completion instructions.
- The students were instructed to tear off the strip on which his or her name was written.
- Concomitantly with organizing survey packets, the post-test for Treatment and Control groups were labeled with the unique number and the tear-off name label of the student.
- Upon receipt of the post-test, the students were instructed to tear off the identifying name label.
- There was no list kept that matches the students' unique number to their names.

The primary researcher distributed the survey packets containing the Demographic Survey, Sleep Quality Index, SF-36v2, and Sleep Hygiene Awareness and Practice Scale. The directions for completion of the packet were read to ensure that the participants completed the forms correctly. The participants were reminded to remove their tear-off name strip from the packet. The participants were then asked to write their best estimates and use one answer rather than a range of answers (use 7 rather than 7 - 11) for fill-in-the blank items, such as the time they fall asleep. If the participant was

unsure, the instructions were to make an educated guess rather than leave the item blank. They were instructed to turn the survey over upon completion and then to work quietly on other materials. The primary researcher collected the instruments upon completion. Participants with concerns about sleep difficulties were informed they could discuss these matters with the primary researcher at the end of the study.

Part B

From the total sample population, six classes were randomly selected for the Treatment group and seven classes were randomly selected to comprise the Control group which resulted in 76 participants in each group. The drawing of lots was done by a faculty member at the school who did not participate in the study.

After completion of all the Survey Packets, presentations were made to the treatment and control groups. The treatment group received the Sleep Treatment and Education Program for Students. The control group received the Alcohol Prevention Presentation. The presentations were made to 13 classes (six Treatment groups and seven Control groups). All presentations were delivered by the lead researcher.

Six to nine weeks later the post-test information was gathered. The primary researcher redistributed the survey packets to the thirteen groups. The survey packets for the post-test consisted of the Demographic Survey, Sleep Quality Index, and Sleep Hygiene Awareness and Practice Scale. The directions for completion of the packet were read to ensure participants would complete the forms correctly. They were asked to write their best estimates and use one answer rather than a range of answers (use 7 rather than 7 - 11) for fill-in-the blank items, such as the time they fall asleep; if the student was unsure, the instructions were to make an educated guess rather than leave the item blank. They were instructed to turn the survey over upon completion and then to work quietly

on other materials. The primary researcher collected the instruments when completed. Participants with concerns about sleep difficulties were informed they could discuss these matters with the primary researcher at the end of the study.

Data Analysis

Several statistical analyses were performed to test the hypotheses. Frequency and percentages were calculated for grade in school, ethnicity, and gender. Means, standard deviations, and ranges were calculated for ages. Data was inspected for skewness, kurtosis, outliers, and other potential problems.

Hypothesis 1A was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep duration, gathered from the Sleep Hygiene Awareness and Practice Scale (difference between “What time do you fall asleep?” question two and “What time do you wake up?” question three) and participants’ Grade Point Averages for the fall semester gathered from the JPAMS computer system of the school.

Hypothesis 1B was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep quality gathered from the Sleep Quality Index total score and participants’ Grade Point Averages for the fall semester gathered from the JPAMS computer system of the school.

Hypothesis 2A was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep duration, gathered from the Sleep Hygiene Awareness and Practice Scale (difference between “What time do you fall asleep?” question two and “What time do you wake up?” question three) and general physical health gathered from SF-36v2, Physical Health Component Summary score.

Hypothesis 2B was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep quality, gathered from the Sleep Quality Index total score sleep quality, and general physical health gathered from SF-36v2, Physical Health Component Summary score.

Hypothesis 3A was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep duration, gathered from the Sleep Hygiene Awareness and Practice Scale (difference between “What time do you fall asleep?” question two and “What time do you wake up?” question three) and general mental health gathered from SF-36v2, Mental Health Component Summary score.

Hypothesis 3B was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep quality, gathered from the Sleep Quality Index total score and general mental health gathered from SF-36v2, Mental Health Component Summary score.

Hypothesis 4A was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep duration, gathered from the Sleep Hygiene Awareness and Practice Scale (difference between “What time do you fall asleep?” question two and “What time do you wake up?” question three) and participants’ total number of absences for the fall semester gathered from the JPAMS computer system of the school.

Hypothesis 4B was tested through correlation analysis. A Pearson product-moment coefficient was calculated to determine the relationship between sleep quality gathered from the Sleep Quality Index total score and participants’ total number of absences for the fall semester gathered from the JPAMS computer system of the school.

Hypothesis 5 was tested using a repeated measures mixed ANOVA with a Bonferroni correction. The within subjects' factor was time and had two levels: pre-test and post-test. The between subjects' factor was treatment condition and had two levels: the control condition and experimental condition. The dependent variables were duration of sleep as measured using data from the Sleep Hygiene Awareness and Practice Scale (difference between "What time do you fall asleep?" question two and "What time do you wake up?" question three).

Hypothesis 6 was tested using a repeated measures mixed ANOVA with a Bonferroni correction. The within subjects' factor was time and had two levels: pre-test and post-test. The between subjects' factor was treatment condition and had two levels: the control condition and experimental condition. The dependent variable was sleep quality as measured by the Sleep Quality Index total score.

Hypothesis 7 was tested using a repeated measures mixed ANOVA with a Bonferroni correction. The within subjects' factor was time and had two levels: pre-test and post-test. The between subjects' factor was treatment condition and had two levels: the control condition and experimental condition. The dependent variable was sleep hygiene knowledge taken from the total score of the SHAPS Awareness section.

Hypothesis 8 was tested using a repeated measures mixed ANOVA with a Bonferroni correction. The within subjects' factor was time and had two levels: pre-test and post-test. The between subjects' factor was treatment condition and had two levels: the control condition and experimental condition. The dependent variable was sleep hygiene knowledge taken from the total score of the SHAPS Practice section.

For hypotheses five through eight, the effect sizes of the results were calculated using the multivariate eta square. The normality assumptions of the statistical tests were

verified. The assumption of sphericity (equal population variances) did not need to be met since there were only two levels of within and between subject factors (Green et al., 1999). Difference scores for the participants will be examined using a scatter plot to ensure they are independent. Alpha levels for correlation analyses were set at .05. Alpha levels for repeated measures mixed ANOVA's were set at .01 based on Bonferroni to compensate for comparison of four pairs of variables.

CHAPTER THREE

RESULTS

Sleep Duration

Participants reported weekday sleep hours ranging from 2 to 12 hours nightly with an average of 7 hours 30 minutes ($M = 7.5$, $SD = 1.16$). Twenty-five percent slept 6 hours 30 minutes or less during the week, and 3.4% slept 9 hours or more. The average amount of sleep for this sample (see Table 1) of 7.54 hours nightly was significantly ($t_{440} = .520$, $p = .000$) more than the 7.07 hours reported by Wolfson and Carskadon (1998) or the 6.7 hours described by Elliason and colleagues (2003). Although this sample slept on the average at least 30 minutes more than previous samples, their sleep amounts were significantly less ($t_{440} = -26.339$, $p = .000$) than the nine hours recommended by experts (NSF, 2008; Carskadon, 2002). Many participants are getting significantly less sleep than recommended and more than one in four are getting over two hours of sleep less than recommended.

Sleep Quality

Sleep quality (see Table 1) had a mean of 5.61 ($SD = 3.42$). A majority (68.5%) were classified in the moderate sleep quality range (within the range 2 to 8). Only 11.1% of the sample had good sleep quality (scores of 0 to 1) and 20.4% had poor sleep quality (a range of 9 to 16). Sleep quality of this sample was similar to that of Urponen and colleagues (1991) who found that high school students experienced occasional sleep

difficulties and a majority fell in the middle category. These results were more polarized than those found in a recent study (Vail-Smith, Felts, & Becker, 2009) of college students. Vail-Smith and colleagues found that college students with good sleep quality represented 6.3%, occasional sleep problems 76.6%, and poor sleep quality 11.8% of the sample. The sleep quality of college students by Buboltz and colleagues (2002) were very similar, reporting good sleep quality – 11%, occasional sleep problems – 73%, and poor sleep quality – 15%. The results indicated that a large number of high school students suffer from poor or moderate sleep quality.

Table 1.

Psychometric Properties of the Major Study Variables

Variable	n	M	SD	α	Range		Skew
					Potential	Actual	
SD	441	7.54	1.16	**	0-24	2.0-12.0	-.6
SQ	441	5.61	3.52	.74	0-24	1.0-24.0	.64
GPA	441	2.88	0.76	**	0-4.0	0.1-4.0	-.55
PH	441	49.5	8.26	.94*	5-73	21.5-69.7	-.47
MH	441	44.82	11.04	.93*	2-73	10.0-69.8	-.53
Abs	441	4.38	4.73	**	0-90	0-35	2.42
SHK	441	21.22	4.33	.59	13-39	2-35	.58
SHP	441	29.50	12.95	.63	0-133	5-87	.87

Note. SD = weekday sleep duration; SQ = weekday sleep quality; GPA=grade point average; PH=physical health composite; MH=mental health composite; Abs=total absences from school for first semester; SHK=Sleep Hygiene Knowledge; SHP=Sleep Hygiene Practice. *Cronbach alpha taken from Users Manual for the 36-v2 Health Survey, page 195. (Ware et al., 2007), instrument computer scored; **Cronbach alpha could not be derived; variable consists of a single item.

Physical Health

The physical health composite was within the average range (scores of 45 to 55) as defined by the *User's Manual for the SF-36v2 Health Survey* (Ware et al., 2007). The physical health composite scores (see Table 1) ranged from 21.47 to 69.66. The mean score was 49.4 with a SD of 8.3. The user's manual (Ware et al., 2007) recommends basing all interpretations on a mean score of 50 and an SD of 10, and interpreting any score below 45 as below average compared to the general population. This means that the physical health component scores of these participants are within the average range.

Mental Health

The mental health composite of this sample was at the lower threshold of the average range (scores of 45 to 55) as defined by the *User's Manual for the SF-36v2 Health Survey* (Ware et al., 2007). The mental health composite scores for the participants (see Table 1) ranged from 10.0 to 69.8. The mean score was 44.8 with a SD of 11.0. This means that the mental health of these participants was comparable to the average American.

Sleep Hygiene Knowledge

Sleep knowledge, as measured by the SHAPS, was significantly better than that of college students as reported in Brown (2002). This sample (see Table 1) had a mean of 21.22 with a SD of 4.33. These results were significantly lower, thereby indicating better sleep knowledge ($t_{440} = -6.537, p = .000$) than those of Brown's college sample ($n = 122$). This means that participants of this study have a higher level of knowledge about sleep hygiene than a sample of college students.

Sleep Hygiene Practice

Sleep hygiene practices of the adolescent participants were also measured by the SHAPS and found to be significantly better (a lower score) than the sample of college students from Brown's (2002) study. The high school students had a mean of 29.50 with a SD of 4.33 which was significantly lower, indicating better sleep practice ($t_{440} = -13.667, p = .000$) than those of Brown's sample of college students ($n = 122$). This indicates that this sample of high school students was better at practicing sleep hygiene than a sample of college students.

Results for Hypotheses

Hypothesis 1A

Hypothesis 1A states: "There will be a significant positive relationship between sleep duration and Grade Point Average from the previous semester." A Pearson product-moment coefficient was calculated and a correlation of .03 ($p = .57$) was obtained. A significant relationship was not found between sleep duration and Grade Point Average from the previous semester (see Table 2). This indicates there is no relationship between sleep duration and grades and these results do not provide support for hypothesis 1A.

Table 2.

Correlation of the Major Study Variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Age	--								
2. SD	-.07	--							
3. SQ	.03	-.24**	--						
4. GPA	-.06	.03	-.03	--					
5. PH	-.04	.04	-.20**	.24**	--				
6. MH	-.13**	.24**	-.48**	.02	-.04	--			
7. Abs	.20**	-.06	.13**	-.24**	-.17**	-.12**	--		
8. SHK	.05	.08	-.01	-.28**	-.20**	-.02	.09	--	
9. SHP	.10*	-.19**	.50**	-.24**	-.16**	-.39	-.20**	.18**	--

Note. SD = weekday sleep duration; SQ = weekday sleep quality; GPA=grade point average; PH=physical health composite; MH=mental health composite; Abs=total absences from school for first semester; SHK=Sleep Hygiene Knowledge; SHP=Sleep Hygiene Practice; * $p < .05$; ** $p < .01$.

Hypothesis 1B

Hypothesis 1B states: “There will be a significant negative relationship between sleep quality and Grade Point Average from the previous semester.” A Pearson product-moment coefficient was calculated and a correlation of $-.03$ ($p = .52$) was obtained. A significant relationship was not found between sleep quality and Grade Point Average. This indicates there was no relationship between sleep quality and grades and the results do not provide any support for hypothesis 1B.

Hypothesis 2A

Hypothesis 2A states: “There will be a significant positive relationship between sleep duration and general physical health for the previous month.” A Pearson product-moment coefficient was calculated and a correlation of $.04$ ($p = .42$) was obtained. A

significant relationship was not found between sleep duration and general physical health from the previous month, indicating that there is no relationship between sleep duration and physical health. The results did not provide support for hypothesis 2A.

Hypothesis 2B

Hypothesis 2B states: “There will be a significant negative relationship between sleep quality and general physical health for the previous month.” A Pearson product-moment coefficient was calculated and a correlation of $-.20$ ($p = .00$) was obtained. There was a significant negative relationship between sleep quality and general physical health during the previous month. This means that students who experienced better sleep quality also experienced better physical health. These results provided support for hypothesis 2B.

Hypothesis 3A

Hypothesis 3A states: “There will be a significant positive relationship between sleep duration and general mental health for the previous month.” A Pearson product-moment coefficient was calculated and a correlation of $.24$ ($p = .00$) was obtained. The significant positive relationship between sleep duration and general mental health during the previous month indicates that sleeping longer is related to better mental health. These results provided support for hypothesis 3A.

Hypothesis 3B

Hypothesis 3B states: “There will be a significant negative relationship between sleep quality and general mental health for the previous month.” A Pearson product-moment coefficient was calculated and a correlation of $-.48$ ($p = .00$) was obtained. There was a significant negative relationship between sleep quality and general mental health during the previous month. This indicates that students who had better sleep quality experienced better mental health. These results provided support for hypothesis 3B.

Hypothesis 4A

Hypothesis 4A states: “There will be a significant positive relationship between sleep duration and school attendance for the previous semester.” A Pearson product-moment coefficient was calculated and a correlation of $-.06$ ($p = .23$) was obtained. There was not a significant relationship between sleep duration and school attendance for the previous semester. The results do not provide support for hypothesis 4A.

Hypothesis 4B

Hypothesis 4B states: “There will be a significant negative relationship between sleep quality and school attendance for the previous semester.” A Pearson product-moment coefficient was calculated and a correlation of $.13$ ($p = .01$) was obtained. There was a significant negative relationship between sleep quality and school attendance for the previous semester. These results indicate that students who had better sleep quality also exhibited better school attendance. These results provided support for hypothesis 4B.

Hypothesis 5

Hypothesis 5 states: “There will be significantly longer overall sleep duration among participants in the treatment group compared to participants in the control group at post-test” (see Table 3). This was tested using a repeated measures mixed ANOVA with Bonferroni corrections; therefore, alpha was fixed at $.013$. The within subjects’ factor was time and had two levels: pre-test and post-test. The between subjects’ factor was treatment and had two levels: the control and experimental condition. The dependent variable was duration of sleep. There was no main effect ($F(1, 150) 1.345, p = .248, \eta^2 = .009$). There was not significantly longer sleep duration among participants in the treatment group compared to participants in the control group at post-test. The results

show that the thirty minute psychoeducational sleep training did not result in students sleeping longer and this does not provide support for hypothesis 5.

Hypothesis 6

Hypothesis 6 states: “There will be significantly higher subjective sleep quality among participants in the treatment group compared to participants in the control group at post-test.” This was tested using repeated measures mixed ANOVA with Bonferroni corrections; therefore, alpha was fixed at .013. The within subjects’ factor was time and had two levels: pre-test and post-test. The between subjects’ factor was treatment and had two levels: the control and experimental condition. The dependent variable was sleep quality as measured by the total score on the Sleep Quality Index (SQI). Be aware that better sleep quality is indicated by lower scores on this instrument. There was no main effect ($F(1, 150) = .636, p = .427, \eta^2 = .004$). The subjective sleep quality among participants in the treatment group was not significantly better than that of participants in the control group at post-test (Table 3). Results do not provide support for hypothesis 6.

Table 3.

Hypotheses 5 through 8: Measurements at initial assessment and at post-treatment

Measure	Condition	Initial	Post-Treatment	F	p	η^2
		M (SD)	M (SD)			
SD	Treatment	7.71 (1.19)	7.75 (1.06)			
SD	Control	7.58 (1.10)	7.48 (1.60)	1.345	.248	.009
SQ	Treatment	5.74 (3.59)	5.05 (3.64)			
SQ	Control	5.16 (3.24)	4.82 (3.22)	0.636	.427	.004
SHK	Treatment	22.34 (4.37)	20.89 (4.98)			
SHK	Control	21.32 (3.72)	20.18 (3.87)	1.345	.248	.009
SHP	Treatment	32.64 (13.82)	29.75 (13.92)			
SHP	Control	30.42 (12.40)	29.49 (14.02)	0.406	.525	.003

Note. SD=Sleep Duration, SQ=Sleep Quality, SHK=Sleep Hygiene Knowledge, SHP=Sleep Hygiene practice, * $p \leq .0125$ between groups, + $p \leq .0125$ within groups.

Hypothesis 7

Hypothesis 7 states: “There will be significantly improved sleep hygiene knowledge among participants in the treatment group compared to participants in the control group at post-test.” This was tested using repeated measures mixed ANOVA with Bonferroni corrections; therefore, alpha was fixed at .013. The within subjects’ factor was time and had two levels: pre-test and post-test. The between subjects’ factor was treatment and had two levels: the control and experimental condition. The dependent variable was sleep hygiene knowledge as measured by the Sleep Hygiene Awareness section of the Sleep Hygiene Awareness and Practice Scale (SHAPS). Be aware that better sleep knowledge is indicated by lower scores on this instrument. There was no main effect ($F(1, 150) = 2.105, p = .149, \eta^2 = .014$). Measurements of pre- and post-sleep hygiene knowledge found that the treatment group’s mean sleep hygiene knowledge improved from 22.34 to 20.89 while the control group’s mean sleep hygiene knowledge

improved from 21.32 to 20.18. There was no significantly improved sleep hygiene knowledge among participants in the treatment group compared to participants in the control group at post-test. Examining the within-subjects contrasts of the treatment group indicated that the improvement in sleep hygiene knowledge was not significant ($F(1, 150) = .207, p = .650, \eta^2 = .001$). Results provide no support for hypothesis 7.

Hypothesis 8

Hypothesis 8 states: “There will be significantly improved sleep hygiene practices for participants in the treatment group compared to participants in the control group at post-test.” This was tested using repeated measures mixed ANOVA with Bonferroni corrections; therefore, alpha was fixed at .013. The within subjects’ factor was time and had two levels: pre-test and post-test. The between subjects’ factor was treatment and had two levels: the control and experimental condition. The dependent variable was sleep hygiene practice as measured by the Sleep Hygiene Practice Scale of the Sleep Hygiene Awareness and Practice Scale (SHAPS). Be aware that better sleep practices are indicated by lower scores on this instrument. There was no main effect ($F(1, 150) = .406, p = .525, \eta^2 = .003$). Sleep hygiene practices for participants in the treatment group did not significantly improve compared to students in the control group at post-test. Measurements of pre- and post-sleep hygiene practices found that the treatment group’s mean sleep practices improved from 32.64 to 29.75 while the control group’s mean sleep practices improved from 30.42 to 29.49. Results do not provide support for hypothesis 8.

CHAPTER FOUR

DISCUSSION

Significant Findings

This study was comprised of two parts. Part A explored the prevalence of sleep difficulties in high school students and their relationship to academic performance, physical health, mental health, and absences. Part B focused on the affect of a thirty minute psychoeducational presentation on high school students' sleep duration, sleep quality, sleep hygiene knowledge, and sleep hygiene practices.

This chapter begins with a broad overview of the two parts of the research, which is followed by a discussion of the formal hypotheses. A summary of the significant findings and implications of those findings is presented next. Limitations and future directions are then discussed.

General findings Part A

The findings of this study show that the majority of participants do not sleep enough hours and do not experience good quality sleep. Adequate sleep duration and good sleep quality were related to good health. Better mental health was associated with better sleep duration and better sleep quality. This may mean that those who sleep longer and with better quality tends to have better mental health characteristics.

The relationship between physical health and sleep was more varied. There was a significant relationship between physical health and sleep quality but no relationship

between sleep duration and physical health. A relationship was also found between good sleep practices and both sleep duration and sleep quality. It may be that those who use good sleep practices sleep longer and experience better sleep quality. Both better sleep duration and sleep quality may be related to habits such as avoiding caffeine and alcohol before bed, setting a time to relax before bed, having a comfortable environment for sleep, avoiding daytime naps, and maintaining consistent bedtimes.

Sleep duration of participants was related to quality of sleep and to sleep hygiene practices. The participants slept an average of 7 hours 30 minutes on week nights. There was a wide range of sleep duration, ranging from two to 12 hours nightly. Twenty-five percent of the participants slept 6 hours 30 minutes or less during the week while only 3.4% slept nine hours or more. Participants in this sample slept at least thirty minutes longer on average than students in previous studies and nearly half (44%) slept eight hours or more. The participants still slept significantly less than the nine hours recommended by sleep experts. Over 96% of the participants in this study slept less than the recommended amount and more than one in four regularly slept more than two hours less than recommended.

Sleep quality was related to sleep duration, physical health, mental health, school absences, and sleep practices. This may indicate that quality sleep, even more than sleep duration, was related to outcomes. Results show that poor sleep quality is a concern for these participants. Only 11% of the sample had good sleep quality, over 20% indicated that their sleep quality was poor, and the majority had moderate sleep quality. This means that nearly nine of ten participants regularly experience moderate to poor sleep quality. An examination of the item responses revealed both positive and negative traits of these participants. Four out of five participants do not experience insomnia and also four of

five do not take any sleep medications. Disturbingly, three out of five participants reported feeling mostly tired in the mornings. Additionally, half of the participants reported difficulties falling asleep and half reported disturbed sleep. This may indicate that these participants are not having major sleep problems, but they are experiencing sufficient sleep difficulties to feel tired each morning from lack of sleep. These participants are high school students and so they have strict morning schedules imposed by the school system. They have little control over wake times but they can control their bed times. Adolescents are striving for more control over their lives so they may stay up later in an attempt to take control of their lives and possibly to feel more grown-up. Family issues may impact students' sleep habits. Parents may have little information about the importance of sleep and therefore do not supervise appropriate bedtimes to help their children get a good night's sleep. Other reasons for lack of sleep may be due to difficulties in falling asleep and staying asleep that may be based in neurological maturational causes (Campbell et al., 2007).

The relationship between sleep and academic markers was not clear cut. The participant's grade point average was not related to sleep duration or sleep quality. Relationships were found between GPA and physical health, mental health, attendance, and sleep practices. This means that fewer absences and better physical and mental health were related to better grades. This may indicate that better school attendance and better grades may be related to students who feel good, mentally and physically, and practice good sleep habits. The lack of relationship between sleep length or sleep quality and GPA in this study, compared to other studies (Wolfson et al., 2003; 1998), may be due to such factors as reduced parental supervision over bedtimes or the neurological changes of adolescents that make falling asleep at an early time more difficult. School attendance

was related to sleep quality but not to sleep length. Specifically, students who had better sleep quality tended to miss school less often. Sleep length has been found in other studies (Wolfson et. al., 2003) to be related to poor school attendance. The lack of findings in this study may be due to the emphasis schools and families place on regular attendance. The students may be attending school even though they feel sleepy and tired due to lack of sleep.

This study found that high school students in general have poor sleep duration. They sleep only seven and one-half hours per night, which is much less than the nine hours or more recommended by experts (National Sleep Foundation, 2011; Carskadon, 2002). Less than four percent of participants slept the recommended nine hours. This means that the vast majority are functioning on less than optimal sleep. A relationship between sleep duration and good sleep practices was found. This would tend to mean that the practices of good sleep habits are related to an increase in sleep duration. Such good sleep habits include consistent amount of nightly sleep, relaxing before bedtime, avoiding caffeine or alcohol four hours before bed, and an environment conducive to sleep. Reduced duration of sleep may be due to required early wake times to fit school schedules, less parental supervision over bedtimes, and/or difficulty falling asleep early due to adolescent neurological changes.

Based on the results of this study, sleep duration and sleep quality are related. This means that longer sleep duration is related to better sleep quality. Participants who slept longer may have felt less tired in the mornings and possibly remained asleep until time to arise. Both of these are characteristics of good quality sleep, or it may mean that students who have good quality sleep are able to sleep for longer durations. Students who experience good quality sleep by falling asleep quickly, remaining asleep throughout the

night, and who do not suffer insomnia may be experiencing average to longer sleep durations.

Additionally, both sleep duration and sleep quality were related to good sleep practices. This means that following good sleep hygiene practices promotes improvement in both sleep duration and sleep quality. Practicing good sleep hygiene on a regular basis, such as avoiding caffeine and alcohol four hours before bed, refraining from worry about the day, consistent amount of sleep each day, and an environment conducive to restful sleep, may provide the opportunity for students to sleep longer with higher quality.

General Findings of Part B

This study found that a thirty minute psychoeducational program did not significantly change students' behaviors in sleep duration, sleep quality, sleep hygiene knowledge, or sleep hygiene practices. The results are in contradiction to Brown (2002) who found that a similar psychoeducational program (STEPS) conducted with college students resulted in significantly improved sleep quality and sleep hygiene practices. Brown's study however did not find a significant difference when measuring for sleep duration and sleep hygiene knowledge.

The ineffectiveness of the intervention may be due to several reasons. Changing behaviors and increasing knowledge is a difficult task. Possible reasons that the intervention was unsuccessful may be factors such as systemic scheduling issues, presentation deficiencies, family issues, and personal issues.

A primary reason for lack of change may be that high school students have less control over their schedules than college students. Wake-up times are set to follow the school schedule and are not changeable by the student. This issue is particularly difficult for students who regularly ride a bus to school. Bus routes may require students to spend

up to an additional hour riding a bus before arriving at school which may push back morning rise time to as early as five o'clock in the morning. Those students would need to go to bed by eight o'clock to get their required nine hours of sleep. It may be that few adolescents would do that. Bedtimes may be more under adolescents' control and therefore pushed back in an effort to be more adult or to seem more mature. Even students who attempt to go to bed early may have difficulties due to the biological neurological changes they are experiencing.

The process of the psychoeducational presentation may have been ineffectual. High school students may need a different educational approach. A one session, thirty minute presentation may not have the necessary repetition and reinforcement to be effective. High school students are accustomed to lectures and repeated presentations. A one-time presentation may not carry the weight or importance of the usual material that is repeated and drilled. This presentation was also a unique addition to their schedule. It was a non-graded presentation that did not require attention, was not to be tested, and may not have been perceived as important or relevant.

Family life factors may have interfered with the success of this process. Parents were not provided with the important information from this presentation. The families may not have known the importance of sleep issues nor ways to encourage or reinforce good sleep habits. Family habits of eating, sleeping, and interacting are established and may not be changed by a single family member. Some participants also reported that basic environmental issues such as disturbances of light or sounds and going to bed hungry were barriers to good sleep. Some of these factors may be out of the students' control. Possibly more information for families may improve the chances for success among high school populations.

High school students may have been less receptive to information concerning sleep. The students may feel invincible as adolescents and see no need to change habits described as detrimental by adults. They may see themselves as impervious to affects from poor sleep habits. They may also be less likely to receive and process information concerning their personal habits.

Discussion of Hypotheses

Interpretation of Hypothesis 1A. Hypothesis 1A examined the relationship between sleep duration and Grade Point Average. There was no relationship between the average daily amount of sleep and GPA. Several possible reasons may explain these findings. These participants reported longer sleep than some previous studies, which may cover up any relationship between sleep duration and school academic performance. The average sleep duration of these participants was seven hours, thirty minutes, which was longer by nearly an hour than the six and one-half hours reported in other studies (Eliasson et al., 2002; Hicks et al., 1991).

There may be no relationship between sleep duration and academic achievement because of the lack of control the participants have over their schedule. Students who are driven to make good grades may actually be staying up late, reducing their sleep time, completing assignments or studying. They can control only their bedtime, not their rise time.

Additionally, other factors within the participants' lives may have more impact on sleep than on GPA. Each student has natural ability, a very impactful home environment, study habits, and motivational factors that may better account for variance in GPA.

Interpretation of Hypothesis 1B. Hypothesis 1B examined the relationship between sleep quality and Grade Point Average. There was no relationship between the quality of sleep and GPA. Several possible reasons may explain these findings.

There may be no relationship between sleep quality and GPA for these participants. Most studies concerning sleep quality targeted college students and a relationship between sleep quality and grades has been found. Such research has not been reported with high school students.

The instrument used to measure sleep quality may have been insensitive to minor yet important aspects of sleep quality in adolescents. Future studies may use a more sensitive instrument or additional instruments that will address minor aspects of sleep quality.

The effects of sleep quality may not be sufficiently robust to exhibit a relationship with GPA. Other factors within the participants' lives may have more impact than sleep quality on GPA. Each student has natural ability, a very impactful home environment, study habits, and motivational factors that may better account for variance in GPA.

Interpretation of Hypothesis 2A. Hypotheses 2A examined the relationship between sleep duration and general physical health. No relationship was found in this study between sleep duration and general physical health. There may be several reasons for these results.

Sleep duration and physical health among this sample may not be related. Many studies have identified relationships between physical health and sleep duration. Most other studies identifying health concerns with sleep length focused on adults rather than adolescents. Health factors related to sleep may not yet have emerged or been identified by adolescents.

The participants in this study may not be aware of any possible heightened health risks. Adolescents generally feel invincible and unaware of future health difficulties; therefore, the participants may have under identified health concerns. Additionally, factors other than sleep duration within the participants' lives may have more impact on general health.

Interpretation of Hypothesis 2B. Hypotheses 2B examined the relationship between sleep quality and general physical health. A significant positive relationship was found between sleep quality and general physical health. This means that improved sleep quality was related to good physical health. These findings indicate that quality sleep, even if of shorter duration, is related to good physical health. Quality of sleep factors such as sleeping throughout the night, feeling rested upon arising, and falling asleep quickly may have resulted in more REM sleep which enabled students to feel better physically.

Interpretation of Hypothesis 3A. Hypotheses 3A examined the relationship between sleep duration and general mental health. Mental health factors were related to increased sleep duration. This means there is a relationship between students who sleep longer and students who feel emotionally healthier and happier. This is congruent with previous studies which found that individuals with habitual low sleep amounts experience feelings of emotional imbalance (King et al., 2008; Marshal et al., 2008; Van Cauter et al., 2008; Kutson et al., 2006; Gottlieb et al., 2005; Milman, 2005; Avas et al., 2003; Wolfson et al., 2003; Kelly et al., 2002; Wahlstrom et al., 2001; Wolfson et al., 1998; Taub, 1980; Taub, 1979; Taub, 1978; Taub et al., 1976; Taub et al., 1974).

Interpretation of Hypothesis 3B. Hypotheses 3B examined the relationship between sleep quality and general mental health. Mental health factors were related to

better sleep quality. This means that there is a relationship between students who experience good quality sleep and feelings of emotional health. Quality sleep is comprised of falling asleep quickly, sleeping throughout the night, and feeling rested upon waking. Such experiences may relate to feelings of good mental health.

Interpretation of Hypothesis 4A. Hypotheses 4A examined the relationship between sleep duration and school attendance. The amount of sleep each night was not related to attendance. There may be several reasons for these results. Some adolescents may be able to function better on smaller amounts of sleep, as long as the sleep is of good quality. Some adolescents may have strong family support that requires attendance whether the student feels sleepy or not. Other students may have no such family support and their attendance is determined independently of their sleep amounts. Those students may choose to attend school or skip school based on factors entirely separate from their sleep habits.

Interpretation of Hypothesis 4B. Hypotheses 4B examined the relationship between sleep quality and school attendance. School attendance was related to good sleep quality. This means that students with better sleep quality missed fewer days of school. Students who fall asleep quickly and easily, sleep throughout the night without waking, and feel alert in the morning have fewer absences during the school year. Students who do not experience good quality sleep are more likely to be absent more often.

Interpretation of Hypothesis 5. Hypothesis 5 stated that overall sleep duration would be significantly longer among students in the treatment group compared to students in the control group. The thirty minute psychoeducational sleep program did not result in longer sleep among the participants. The treatment group reported an average of three minutes more sleep versus approximately six minutes less sleep for the control

group. This is hardly a change in total sleep amounts. A similar psychoeducational program presented to college students (Brown, 2002) also resulted in non-significant changes in sleep duration. Several reasons for the lack of increased sleep duration may be hypothesized. The participants may not have considered the presentation as important. The presentation allowed them to get out of class and was not graded; therefore, they may not have been attentive to the information. The participants do not have control over the time they must wake to attend school. Changing their times to go to sleep may not have been important or did not get incorporated into their habitual schedule. Additionally, parents may not provide the necessary support, encouragement, and supervision to assist their children in getting enough hours of sleep.

Interpretation of Hypothesis 6. Hypothesis 6 stated that overall sleep quality would be significantly better among students in the treatment group compared to students in the control group. The psychoeducational sleep program did not result in better sleep quality among the participants. The treatment group reported nearly the same sleep quality before and after the training. Again, the participants may have not considered the presentation of any importance. The presentation allowed them to get out of class but was not graded; therefore, they may not have been attentive to the information. Many other factors may have impacted any improvement in sleep quality. If the participants did not increase the amount of sleep, it was very difficult to also improve the quality of sleep. The information presented in the psychoeducation program was only presented once which may not have been sufficient for the participants to learn, process, and incorporate into their daily routines. Follow-up trainings or formal reinforcement of the skills may have encouraged compliance with better sleep habits that may have improved sleep quality.

Interpretation of Hypothesis 7. Hypothesis 7 stated that sleep hygiene knowledge would improve among students in the treatment group compared to students in the control group. The psychoeducational sleep program did not result in improved knowledge of sleep hygiene factors. The treatment group reported slightly lower (better) scores on sleep knowledge. The participants may have discounted some of the information because it did not agree with their preconceived notions of their sleep needs. Also, the participants may not consider the presentation of any importance since it is not graded or part of their regular class. Furthermore, a single presentation may not have sufficient weight for the participants to remember the information. Therefore, the participants may have listened, or not, and did not remember, process, or incorporate the information into their repertoire of information.

Interpretation of Hypothesis 8. Hypothesis 8 stated that sleep hygiene practices would be significantly better among students in the treatment group compared to students in the control group. The psychoeducational sleep program did not result in improved sleep practices. The treatment group reported slightly better, though not significant, sleep hygiene practices. This means that the participants changed a few of their sleep practices. Again, the participants may have not considered the presentation of any importance. The presentation allowed them to get out of class and was not to be tested; therefore, they may not have attended to the information. Many other factors may have impacted any improvement in sleep hygiene practices. There was no appreciable difference in knowledge of sleep hygiene; therefore, it may be assumed they had few new skills to practice. The information presented in the psychoeducational program was only presented once which may not have been sufficient for the participants to learn, process, and incorporate in their daily routines. Follow-up trainings or formal reinforcement of the

skills may have encouraged compliance with better sleep habits that may have improved sleep practices.

Summary of Significant Findings

This study found that students do not sleep enough hours, experience poor sleep quality, and experience negative consequences for these behaviors. Secondly, it was found that a thirty minute psychoeducational presentation was not effective in increasing sleep amounts, improving sleep quality, increasing sleep hygiene knowledge, or improving sleep hygiene practices.

Part A of the study found that high school students sleep seven and one-half hours on average, much less than the nine or more hours recommended. Good sleep quality was experienced by only 11% of the students. Longer sleep durations were related to good sleep quality, better mental health, and good sleep hygiene practices. Good sleep practices were related to longer sleep duration, good physical health, good mental health, better school attendance, and better sleep hygiene practices. This means that students who sleep for short amounts and have poor sleep quality may experience decreased physical health, poorer mental health, and more school absences.

Part B of the study demonstrated that a single, short presentation was not effective in changing the sleep length, sleep quality, sleep hygiene knowledge, or sleep hygiene practices. The failure of the psychoeducational intervention to demonstrate significant changes in behavior may be due to several factors.

The presentation format, length and number of sessions, may have been insufficient to motivate change. This may indicate that different strategies or types of interventions may be tested and utilized to improve sleep quality and duration among high school students.

The instruments used may be insensitive to minor yet important changes in adolescents. More change in sleep quality, sleep knowledge, and sleep practices may have occurred than was measured.

Methodological problems may have affected the outcome of the intervention. The number of control and treatment participants may have been too small to accurately reflect changes in behavior. More participants would increase the power of the study. Also, these participants, even though randomly selected, may not be an accurate representation of the average adolescent population. Other studies should enlarge the sample and widen the geographic pool from which to draw the sample.

Implications

This study found that high school students are at risk academically, physically, and mentally due to limited sleep and poor sleep quality. Students sleep significantly less than the nine plus hours recommended by authorities. Sleep quality is poor sleep or moderate sleep problems in nearly nine of ten students. The results from this study indicated a relationship between poor sleep and physical health, mental health, and school attendance. Grade point average, though not directly related to sleep in this study, was related to general health and attendance, and by association, it may be related to sleep factors. It is important that action be taken to improve sleep among high school students. This study found that, unlike college students, a thirty minute psychoeducational program was not sufficiently effective to change their knowledge of sleep, sleep practices, sleep duration, or sleep quality. Additional actions or interventions may be needed. There may need to be an expanded sleep training program spaced out over a longer period of time to provide a more effective psychoeducational basis for sleep hygiene learning and practice. Students may need to be encouraged and reinforced to improve their sleep practices.

Parents may need to be enlisted to help in assisting their children to improve sleep practices. Schools may need to consider their schedules to address the needs and developmental stages of adolescents. For example, the Minnesota school system employed later school start times which allowed students to sleep longer each day, resulting in better school attendance and reduction in drop-outs (Wahlstrom et al., 2001).

Limitations and Future Directions

This study is not without important limitations such as the sample, the instruments used the robustness of the intervention, the motivation of the participants, and involvement of the family. The sample, although drawn randomly, may not have accurately reflected the general population of adolescents. Drawing from a pool of more schools and a wider geographic area may have ensured the sample was more representative. A larger number of participants in the treatment and control groups may have allowed for greater statistical power. Two components of the Sleep Hygiene Awareness and Practice Scale, the Sleep Hygiene Knowledge scale and the Sleep Practice scale, had low alphas. This indicates that the instruments did not strongly measure the concepts of sleep knowledge and sleep practice. The instruments were designed for college students. Although the instruments were slightly modified to more appropriately address high school age students, the instruments may not have provided a good measure of the targeted concepts. The participants of this study may not have the cognitive capacity or possibly reading comprehension to give a true representation of their sleep knowledge and practice. The psychoeducational presentation, although adequate for college students, may not be sufficiently robust for high school students. The intervention may need to be longer and possibly repeated or reinforced more successfully to meet the needs of high school students. The study may have been limited

by the motivation of the students. The study did not have motivational factors such as rewards or grades to provide encouragement for the participants to change their targeted behavior. Future studies may consider adding such a component. The study did not involve the family system. Permission for the study was gained from parents but no information was provided directly to the family and no expectations were communicated to the family. Future studies of sleep and adolescents may consider involving the family system to increase general knowledge of the importance of sleep and to assist participants in behavior change.

This study found a larger percentage (20.8%) of students who expressed poor sleep quality than samples of college students. Therefore, it may be speculated that students with longer sleep duration and better knowledge and practices of sleep hygiene may still experience poor sleep quality. Further study of sleep hygiene factors among adolescents may be needed.

The treatment of one session psychoeducational training in sleep hygiene did not significantly improve sleep duration, sleep quality, sleep hygiene knowledge, or sleep hygiene practices as compared to the control group. Even though there was no significant improvement based on the intervention, sleep duration of the treatment group increased as opposed to the decrease in sleep duration for the control group. Also, a trend toward better sleep quality and better sleep practices were noted in the treatment group and not the control group. The lack of significant change in these factors may be due to a weakness in a one session training format. One session may not be a strong enough treatment to change behavior significantly. Further study using a longer or more robust treatment model may increase the trends indicated in this study.

Parents' understanding, support, and encouragement of sleep factors are another important factor to consider for further study. Parents continue to have influence over the day to day functioning of their high school children. High school students' wake time is established by the school schedule. In order for students to increase their sleep duration they must go to sleep earlier. High school students are part of a family system and may base their bedtimes on what is required by their parents. Future studies may explore the knowledge of sleep hygiene of the parents and their support of good sleep habits.

Implications for Practice

The American School Counselor Association (ASCA) states that the majority of the school counselor's time should focus on direct services to students (The American School Counselor Association, 2003). The direct services to students should be comprehensive in scope, preventive in design, and developmental in nature (The American School Counselor Association, 2003). Baker and Gerler (2001) agreed that developmental guidance should keep in focus the goal of preventing problems in the lives of students through social, cognitive, and emotional growth. Good sleep duration and sleep quality are important factors in the development of healthy adults. Trends found in this study may indicate that a robust psychoeducational program may be effective in increasing sleep duration, improving sleep quality, and fostering more effective sleep practices. Dixon-Rayle and Myers (2004) recommended that counselors use psychoeducation presentations about good habits essential to healthy development. Almost too plain to be discussed, a good night's sleep is obviously a good habit needed for healthy development.

The American School Counselor Association (ASCA) developed the ASCA National Standards: Developmental Crosswalking Tools to assist guidance counselors in

planning a comprehensive guidance curriculum for use with their students (The American School Counselor Association, 2003). There are at least seven specific recommendations that would benefit from the inclusion of sleep hygiene information. Some specific recommendations include how to “demonstrate the ability to balance school, studies, extracurricular activities, leisure time and family life and the ability to understand the need for self-control and how to practice it” (The American School Counselor Association, 2003).

The Academic Development Domain is a major area of focus for school counselors. Although this study did not find a direct correlation between Grade Point Average and sleep duration or sleep quality, there are many studies that link academic performance to sleep. Several studies have linked short sleep duration to lapses of attention (Alhola et al., 2007; Banks et al., 2007; and Hicks et al., 1981). Studies have also established links between general overall poor school performance (Wolfson et al., 2003) and problems such as poor attendance and early withdrawal (Wahlstrom et al., 2001, Brown, 2002). This study did find that better sleep quality was correlated to fewer absences. Similar to findings of others (e.g.: Kelly et al., 2001; Wolfson et al., 1998), this study found a correlation between higher Grade Point Average and getting more than nine hours of sleep.

Some of the goals mentioned in the ASCA’s National Model include the ability to “identify attitudes and behaviors that lead to successful learning and demonstrate the ability to balance school, studies, extracurricular activities, leisure time, and family life” (The American School Counselor Association, 2003, pp. 88). Specific methods to enhance good sleep practices as part of a balanced life appears to be a worthwhile topic for school counselors to discuss during curriculum activities.

Furthermore, within the Career Development Domain, students should be able to “understand the relationship between educational achievement and career success” (The American School Counselor Association, 2003, pp. 90). This goal again offers the opportunity to present to students the importance of sleep and methods to incorporate good sleep practices as part of the balance between work and lifestyles.

The Personal/Social Domain is also an area in which counselors can teach sleep hygiene concepts. Some appropriate goals within this domain include the following: “understand the need for self-control and how to practice it, and develop effective coping skills for dealing with problems” (The American School Counselor Association, 2003, pp. 91-92). These goals encourage school counselors to address the use of self-control in putting into practice the sleep hygiene knowledge and skills as a way to cope with stress, fatigue, and feelings of depression. This study found that both longer sleep duration and better sleep quality were significantly correlated with better mental health. Further evidence was found in previous studies that sleep affects emotions and self control. For example, studies have found that impaired sleep is correlated with emotional imbalance, feelings of tension, anxiety, anger, depression, and mood or behavioral problems (Picher et al., 1997; Morrison et al., 1992; and Taub et al., 1974).

Three goals are presented within the Personal/Social Domain to train students to acquire personal safety skills: (1) “apply effective problem solving and decision making skills to make safe and healthy choices, (2) learn techniques for managing stress and conflict, and (3) learn coping skills for managing life events” (The American School Counselor Association, 2003, pp. 92). These goals are directly related to good sleep hygiene knowledge and practice because it impacts both health and long-term safety. Some studies have also shown that sleep and health issues are related. For example, poor

sleep habits have been linked to unhealthy physiology (Banks & Dinges, 2007), obesity (Cauter et al., 2008; Marshall et al., 2008; Kohatsu et al., 2006), diabetes (Knutson et al., 2006; Gottlieb et al., 2005), and coronary problems (King et al., 2008; Peker et al., 2006; Avas et al., 2003).

In summary, it is recommended that school counselors add sleep hygiene to their comprehensive school counseling program through psychoeducational presentations. Sleep hygiene is an important part of the health and well-being of all students and it fits within the recommended curriculum from The American School Counselor Association. It is suspected that the trends identified in this study, namely, the importance of sleep hygiene, may be continued and strengthened through a longer and more robust psychoeducational format.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL



LOUISIANA TECH
UNIVERSITY

MEMORANDUM

OFFICE OF UNIVERSITY RESEARCH

TO: Mr. John Wallace and Dr. Buboltz

FROM: Barbara Talbot, University Research

SUBJECT: HUMAN USE COMMITTEE REVIEW

DATE: December 1, 2009

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

**"Sleep Quality, Academic Performance, and Absences among
High School Students"**

HUC-700

The proposed study's revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. *This approval was finalized on November 16, 2009 and this project will need to receive a continuation review by the IRB if the project, including data analysis, continues beyond November 16, 2010.* Any discrepancies in procedure or changes that have been made including approved changes should be noted in the review application. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of University Research.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Research or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

If you have any questions, please contact Dr. Mary Livingston at 257-4315.

A MEMBER OF THE UNIVERSITY OF LOUISIANA SYSTEM

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APPENDIX B

HUMAN SUBJECTS CONSENT FORM

HUMAN SUBJECTS CONSENT FORM

The following is a brief summary of the project in which you are asked to participate. Please read the information before signing the statement below.

TITLE OF PROJECT: Sleep Quality, Academic Performance and Absences Among High School Students.

PURPOSE OF STUDY/PROJECT: The purpose of this study is to explore if, how, and to what degree sleep factors impact adolescents' health and academic performance.

PROCEDURE: Please give your signature as consent and the assent of your child. Your child will complete a questionnaire concerning sleep habits, physical activities, and general health. Information concerning grade point average, number of absences, and number of suspensions will also be gathered. Some students will receive an educational lecture concerning good sleep habits and some students will receive an educational lecture concerning the dangers of alcohol abuse.

INSTRUMENTS: The instruments used are self-report questionnaires asking information about general information, duration and quality of sleep, physical health, mental health, knowledge of good sleep habits, and physical activity. All information will remain confidential and the names of individual students will not be attached to their responses.

RISKS/ALTERNATIVE TREATMENTS: The participant understands that Louisiana Tech is not able to offer financial compensation nor to absorb the costs of medical treatment should you be injured as a result of participating in this research.

BENEFITS/COMPENSATIONS: Individual teachers will have the option of granting extra points in their class for participation. In those classes, students who choose not to participate will have the opportunity to earn those same extra points through other activities such as writing a short paper.

The below signature of parent/guardian indicates consent and my child's signature confers assent. I have read and understood the following description of the study, "Sleep Quality, Academic Performance, and Absences Among High School Students," its purposes and methods. I understand that my child's participation in this research is strictly voluntary and my participation or refusal to participate in this study will not affect my relationship with Lincoln Parish Schools or my grades in any way. Further, I understand that my child may withdraw at any time or refuse to answer any questions without penalty. Upon completion of this study, I understand that the results will be freely available to me upon request. I understand that the results of my survey will be confidential, accessible only to the principle investigators, myself, or legally appointed representative. I have not been requested to waive nor do I waive my rights related to participating in this study.

Parent/Guardian Signature

Student Signature

Date

CONTACT INFORMATION: The principal experimenters listed below may be reached to answer questions about the research, subject's rights, or related matters.

John Wallace (982-72570

Walter Buboltz, PhD (257-4315)

Members of the Human Use Committee of Louisiana Tech University may also be contacted if a problem cannot be discussed with the experimenters:

Dr. Les Guice (257-3056)

Dr. Mary Livingston (257-4315)

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